Figure 1: construction of a synthetic human antibody library based on consensus sequences

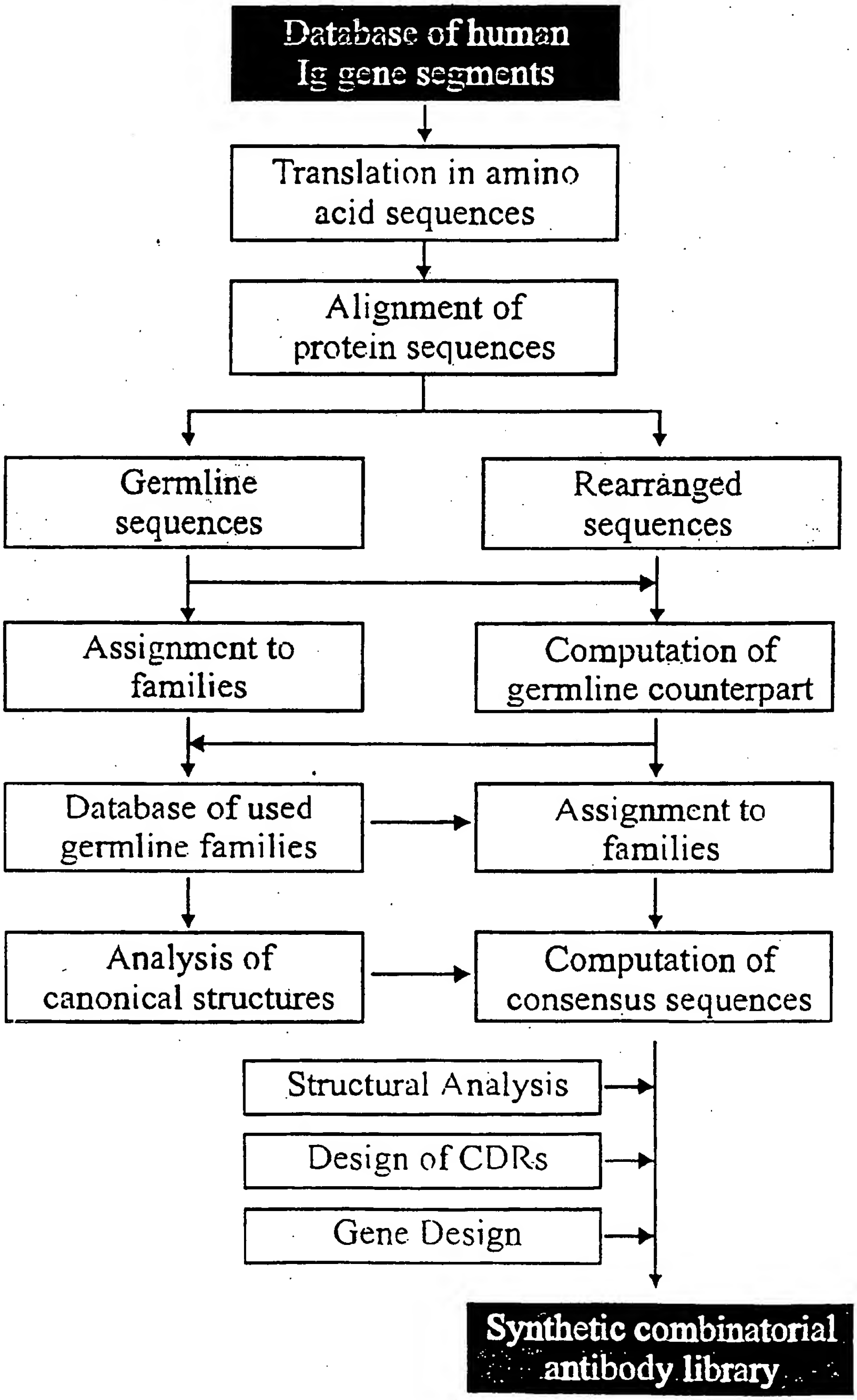

Figure 2A: VL kappa consensus sequences

	framework 1																							CDRI						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	A	B	C
Vκ1	D	I	Q	M	T	Q	S	P	S	S	L	S	A	S	V	G	D	R	V	T	I	T	C	R	A	S	Q	-	-	-
Vκ2	D	I	V	M	T	Q	S	P	L	S	L	P	V	T	P	G	E	P	A	S	I	S	C	R	S	S	Q	S	L	L
Vκ3	D	I	V	L	T	Q	S	P	A	T	L	S	L	S	P	G	E	R	A	T	L	S	C	R	A	S	Q	S	-	-
Vκ4	D	I	V	M	T	Q	S	P	D	S	L	A	V	S	L	G	E	R	A	T	I	N	C	R	S	S	Q	S	V	L

	CDRI							framework 2																CDR II				
	D	E	F	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Vκ1	-	-	-	G	I	S	S	Y	L	A	W	Y	Q	Q	K	P	G	K	A	P	K	L	L	I	Y	A	A	S	S	L
Vκ2	H	S	-	N	G	Y	N	Y	L	D	W	Y	L	Q	K	P	G	Q	S	P	Q	L	L	I	Y	L	G	S	N	R
Vκ3	-	-	-	V	S	S	S	Y	L	A	W	Y	Q	Q	K	P	G	Q	A	P	R	L	L	I	Y	G	A	S	S	R
Vκ4	Y	S	S	N	N	K	N	Y	L	A	W	[illegible]	Q	Q	K	P	G	Q	P	P	K	L	L	I	Y	W	A	S	T	R

Figure 2A: VL kappa consensus sequences

	CDRII		framework 3																											
	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
Vκ1	Q	S	G	V	P	S	R	F	S	G	S	G	S	G	T	D	F	T	L	T	I	S	S	L	Q	P	E	D	F	A
Vκ2	A	S	G	V	P	D	R	F	S	G	S	G	S	G	T	D	F	T	L	K	I	S	R	V	E	A	E	D	V	G
Vκ3	A	T	G	V	P	A	R	F	S	G	S	G	S	G	T	D	F	T	L	T	I	S	S	L	E	P	E	D	F	A
Vκ4	E	S	G	V	P	D	R	F	S	G	S	G	S	G	T	D	F	T	L	T	I	S	S	L	Q	A	E	D	V	A

	framework 3				CDRIII								framework 4												
	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109
Vκ1	T	Y	Y	C	Q	Q	H	Y	T	T	P	P	T	F	G	Q	G	T	K	V	E	I	K	R	T
Vκ2	V	Y	Y	C	Q	Q	H	Y	T	T	P	P	T	F	G	Q	G	T	K	V	E	I	K	R	T
Vκ3	V	Y	Y	C	Q	Q	H	Y	T	T	P	P	T	F	G	Q	G	T	K	V	E	I	K	R	T
Vκ4	V	Y	Y	C	Q	Q	H	Y	T	T	P	P	T	F	G	Q	G	T	K	V	E	I	K	R	T

Figure 2B: VL lambda consensus sequences

	framework 1																							CDRI						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	D	E	28
Vλ1	Q	S	V	L	T	Q	P	P	S	-	V	S	G	A	P	G	Q	R	V	T	I	S	C	S	G	S	S	S	N	I
Vλ2	Q	S	A	L	T	Q	P	A	S	-	V	S	G	S	P	G	Q	S	I	T	I	S	C	T	G	T	S	S	D	V
Vλ3	S	Y	E	L	T	Q	P	P	S	-	V	S	V	A	P	G	Q	T	A	R	I	S	C	S	G	D	A	-	-	L

	CDRI							framework 2															CDR II							
	29	30	31	A	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Vλ1	G	S	N	-	Y	V	S	W	Y	Q	Q	L	P	G	T	A	P	K	L	L	I	Y	D	N	N	Q	R	P	S	G
Vλ2	G	G	Y	N	Y	V	S	W	Y	Q	Q	H	P	G	K	A	P	K	L	M	I	Y	D	V	S	N	R	P	S	G
Vλ3	G	D	K	-	Y	A	S	W	Y	Q	Q	K	P	G	Q	A	P	V	L	V	I	Y	D	D	S	D	R	P	S	G

Figure 2B: VL lambda consensus sequences

	framework 3																													
	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
Vλ1	V	P	D	R	F	S	G	S	K	S	G	T	S	A	S	L	A	I	T	G	L	Q	S	E	D	E	A	D	Y	Y
Vλ2	V	S	N	R	F	S	G	S	K	S	G	N	T	A	S	L	T	I	S	G	L	Q	A	E	D	E	A	D	Y	Y
Vλ3	I	P	E	R	F	S	G	S	N	S	G	N	T	A	T	L	T	I	S	G	T	Q	A	E	D	E	A	D	Y	Y

		CDRIII								framework 4											
	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	A	107
Vλ1	C	Q	Q	H	Y	T	T	P	P	V	F	G	G	G	T	K	L	T	V	L	G
Vλ2	C	Q	Q	H	Y	T	T	P	P	V	F	G	G	G	T	K	L	T	V	L	G
Vλ3	C	Q	Q	H	Y	T	T	P	P	V	F	G	G	G	T	K	L	T	V	L	G

Figure 2C: V heavy chain consensus sequences

	framework 1																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
VH1A	Q	V	Q	L	V	Q	S	G	A	E	V	K	K	P	G	S	S	V	K	V	S	C	K	A	S	G	G	T	F	S
VH1B	Q	V	Q	L	V	Q	S	G	A	E	V	K	K	P	G	A	S	V	K	V	S	C	K	A	S	G	Y	T	F	T
VH2	Q	V	Q	L	K	E	S	G	P	A	L	V	K	P	T	Q	T	L	T	L	T	C	T	F	S	G	F	S	L	S
VH3	E	V	Q	L	V	E	S	G	G	G	L	V	Q	P	G	G	S	L	R	L	S	C	A	A	S	G	F	T	F	S
VH4	Q	V	Q	L	Q	E	S	G	P	G	L	V	K	P	S	E	T	L	S	L	T	C	T	V	S	G	G	S	I	S
VH5	E	V	Q	L	V	Q	S	G	A	E	V	K	K	P	G	E	S	L	K	I	S	C	K	G	S	G	Y	S	F	T
VH6	Q	V	Q	L	Q	Q	S	G	P	G	L	V	K	P	S	Q	T	L	S	L	T	C	A	I	S	G	D	S	V	S

	CDRI							framework 2														CDR II										
	31	A	B	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	A	B	C	53	54	55	56	57
VH1A	S	-	-	Y	A	I	S	W	V	R	Q	A	P	G	Q	G	L	E	W	M	G	G	I	I	P	-	-	I	F	G	T	A
VH1B	S	-	-	Y	Y	M	H	W	V	R	Q	A	P	G	Q	G	L	E	W	M	G	W	I	N	P	-	-	N	S	G	G	T
VH2	T	S	G	V	G	V	G	W	I	R	Q	P	P	G	K	A	L	E	W	L	A	L	I	D	-	-	-	W	D	D	D	K
VH3	S	-	-	Y	A	M	S	W	V	R	Q	A	P	G	K	G	L	E	W	V	S	A	I	S	G	-	-	S	G	G	S	T
VH4	S	-	-	Y	Y	W	S	W	I	R	Q	P	P	G	K	G	L	E	W	I	G	Y	I	Y	-	-	-	Y	S	G	S	T
VH5	S	-	-	Y	W	I	G	W	V	R	Q	M	P	G	K	G	L	E	W	M	G	I	I	Y	P	-	-	G	D	S	D	T
VH6	S	N	S	A	A	W	N	W	I	R	Q	S	P	G	R	G	L	E	W	L	G	R	T	Y	Y	R	-	S	K	W	Y	N

Figure 2C: V heavy chain consensus sequences

	CDRII										framework 3																				
	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	A	B	C	83	84	85
VH1A	N	Y	A	Q	K	F	Q	G	R	V	T	I	T	A	D	E	S	T	S	T	A	Y	M	E	L	S	S	L	R	S	E
VH1B	N	Y	A	Q	K	F	Q	G	R	V	T	M	T	R	D	T	S	I	S	T	A	Y	M	E	L	S	S	L	R	S	E
VH2	Y	Y	S	T	S	L	K	T	R	L	T	I	S	K	D	T	S	K	N	Q	V	V	L	T	M	T	N	M	D	P	V
VH3	Y	Y	A	D	S	V	K	G	R	F	T	I	S	R	D	N	S	K	N	T	L	Y	L	Q	M	N	S	L	R	A	E
VH4	N	Y	N	P	S	L	K	S	R	V	T	I	S	V	D	T	S	K	N	Q	F	S	L	K	L	S	S	V	T	A	A
VH5	R	Y	S	P	S	F	Q	G	Q	V	T	I	S	A	D	K	S	I	S	T	A	Y	L	Q	W	S	S	L	K	A	S
VH6	D	Y	A	V	S	V	K	S	R	I	T	I	N	P	D	T	S	K	N	Q	F	S	L	Q	L	N	S	V	T	P	E

	framework 3										CDRIII														framework 4							
	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	A	B	C	101	102	103	104	105	106	107	108	109	110	111	112	113
VH1A	D	T	A	V	Y	Y	C	A	R	W	G	G	D	G	F	Y	A	M	D	Y	W	G	Q	G	T	L	V	T	V	S	S
VH1B	D	T	A	V	Y	Y	C	A	R	W	G	G	D	G	F	Y	A	M	D	Y	W	G	Q	G	T	L	V	T	V	S	S
VH2	D	T	A	T	Y	Y	C	A	R	W	G	G	D	G	F	Y	A	M	D	Y	W	G	Q	G	T	L	V	T	V	S	S
VH3	D	T	A	V	Y	Y	C	A	R	W	G	G	D	G	F	Y	A	M	D	Y	W	G	Q	G	T	L	V	T	V	S	S
VH4	D	T	A	V	Y	Y	C	A	R	W	G	G	D	G	F	Y	A	M	D	Y	W	G	Q	G	T	L	V	T	V	S	S
VH5	D	T	A	M	Y	Y	C	A	R	W	G	G	D	G	F	Y	A	M	D	Y	W	G	Q	G	T	L	V	T	V	S	S
VH6	D	T	A	V	Y	Y	C	A	R	W	G	G	D	G	F	Y	A	M	D	Y	W	G	Q	G	T	L	V	T	V	S	S

Figure 3A: V kappa 1 (Vκ1) gene sequence

```
 .D  I  Q  M   T  Q  S   P  S  S   L  S  A  S   V  G  D
  EcoRV              BanII
~~~~~~~            ~~~~~~~~
GATATCCAGA TGACCCAGAG CCCGTCTAGC CTGAGCGCGA GCGTGGGTGA
CTATAGGTCT ACTGGGTCTC GGGCAGATCG GACTCGCGCT CGCACCCACT

   R  V  T   I  T  C  R   A  S  Q   G  I  S   S  Y  L
                  PstI
                ~~~~~~~~
TCGTGTGACC ATTACCTGCA GAGCGAGCCA GGGCATTAGC AGCTATCTGG
AGCACACTGG TAATGGACGT CTCGCTCGGT CCCGTAATCG TCGATAGACC

A  W  Y  Q   Q  K  P   G  K  A  P   K  L  L   I  Y  A
    KpnI             SexAI                AseI
  ~~~~~~~          ~~~~~~~~~           ~~~~~~~~
CGTGGTACCA GCAGAAACCA GGTAAAGCAC CGAAACTATT AATTTATGCA
GCACCATGGT CGTCTTTGGT CCATTTCGTG GCTTTGATAA TTAAATACGT

  A  S  S  L   Q  S  G   V  P  S   R  F  S  G   S  G  S
                        SanDI                     BamHI
                      ~~~~~~~~~                   ~~~~~
GCCAGCAGCT TGCAAAGCGG GGTCCCGTCC CGTTTTAGCG GCTCTGGATC
```

Figure 3A: V kappa 1 (Vκ1) gene sequence (continued)

```
CGGTCGTCGA ACGTTTCGCC CCAGGGCAGG GCAAAATCGC CGAGACCTAG

  G  T  D   F  T  L  T   I  S  S   L  Q  P   E  D  F
                                        Eco57I
                                        ~~~~~~~~
BamHI                                      BbsI
~                                          ~~~~~~~
CGGCACTGAT TTTACCCTGA CCATTAGCAG CCTGCAACCT GAAGACTTTG
GCCGTGACTA AAATGGGACT GGTAATCGTC GGACGTTGGA CTTCTGAAAC

A  T  Y  Y   C  Q  Q   H  Y  T  T   P  P  T   F  G  Q
                                               MscI
                                              ~~~~~~~
CGACCTATTA TTGCCAGCAG CATTATACCA CCCCGCCGAC CTTTGGCCAG
GCTGGATAAT AACGGTCGTC GTAATATGGT GGGGCGGCTG GAAACCGGTC

 G  T  K  V   E  I  K   R  T
                        BsiWI
                       ~~~~~~
GGTACGAAAG TTGAAATTAA ACGTACG
CCATGCTTTC AACTTTAATT TGCATGC
```

Figure 3B: V kappa 2 (Vκ2) gene sequence

```
 D  I  V  M   T  Q  S   P  L  S   L  P  V  T   P  G  E
 EcoRV             BanII
~~~~~~~           ~~~~~~~~
GATATCGTGA TGACCCAGAG CCCACTGAGC CTGCCAGTGA CTCCGGGCGA
CTATAGCACT ACTGGGTCTC GGGTGACTCG GACGGTCACT GAGGCCCGCT

  P  A  S  I  S  C  R   S  S  Q   S  L  L   H  S  N
                 PstI
                ~~~~~~~~
GCCTGCGAGC ATTAGCTGCA GAAGCAGCCA AAGCCTGCTG CATAGCAACG
CGGACGCTCG TAATCGACGT CTTCGTCGGT TTCGGACGAC GTATCGTTGC

G  Y  N  Y   L  D  W   Y  L  Q  K   P  G  Q   S  P  Q
                  KpnI          SexAI
                 ~~~~~~~~      ~~~~~~~~
GCTATAACTA TCTGGATTGG TACCTTCAAA AACCAGGTCA AAGCCCGCAG
CGATATTGAT AGACCTAACC ATGGAAGTTT TTGGTCCAGT TTCGGGCGTC

 L  L  I  Y   L  G  S   N  R  A   S  G  V  P   D  R  F
   AseI                              SanDI
  ~~~~~~~                           ~~~~~~~~~
CTATTAATTT ATCTGGGCAG CAACCGTGCC AGTGGGGTCC CGGATCGTTT
GATAATTAAA TAGACCCGTC GTTGGCACGG TCACCCCAGG GCCTAGCAAA
```

Figure 3B: V kappa 2 (Vκ2) gene sequence (continued)

```
  S   G   S    G   S   G   T    D   F   T    L   K   I    S   R   V
               BamHI
              ~~~~~~~
TAGCGGCTCT GGATCCGGCA CCGATTTTAC CCTGAAAATT AGCCGTGTGG
ATCGCCGAGA CCTAGGCCGT GGCTAAAATG GGACTTTTAA TCGGCACACC

E   A   E   D    V   G   V    Y   Y   C   Q    Q   H   Y    T   T   P
    Eco57I
    ~~~~~~~
       BbsI
      ~~~~~~~~
AAGCTGAAGA CGTGGGCGTG TATTATTGCC AGCAGCATTA TACCACCCCG
TTCGACTTCT GCACCCGCAC ATAATAACGG TCGTCGTAAT ATGGTGGGGC

 P   T   F   G    Q   G   T    K   V   E    I   K   R   T
          MscI                                  BsiWI
         ~~~~~~~~                              ~~~~~~~
CCGACCTTTG GCCAGGGTAC GAAAGTTGAA ATTAAACGTA CG
GGCTGGAAAC CGGTCCCATG CTTTCAACTT TAATTTGCAT GC
```

Figure 3C: V kappa 3 (Vκ3) gene sequence

```
 D  I  V  L   T  Q  S   P  A  T   L  S  L  S   P  G  E
 EcoRV               BanII
~~~~~~              ~~~~~~~~
GATATCGTGC TGACCCAGAG CCCGGCGACC CTGAGCCTGT CTCCGGGCGA
CTATAGCACG ACTGGGTCTC GGGCCGCTGG GACTCGGACA GAGGCCCGCT

  R  A  T   L  S  C  R   A  S  Q   S  V  S   S  S  Y
                PstI
               ~~~~~~~~
ACGTGCGACC CTGAGCTGCA GAGCGAGCCA GAGCGTGAGC AGCAGCTATC
TGCACGCTGG GACTCGACGT CTCGCTCGGT CTCGCACTCG TCGTCGATAG

L  A  W  Y   Q  Q  K   P  G  Q  A   P  R  L   L  I  Y
     KpnI             SexAI                 AseI
    ~~~~~~~~         ~~~~~~~~~             ~~~~~~
TGGCGTGGTA CCAGCAGAAA CCAGGTCAAG CACCGCGTCT ATTAATTTAT
ACCGCACCAT GGTCGTCTTT GGTCCAGTTC GTGGCGCAGA TAATTAAATA

 G  A  S  S   R  A  T   G  V  P   A  R  F  S   G  S  G
                         SanDI                 BamHI
                        ~~~~~~~                   ~~
GGCGCGAGCA GCCGTGCAAC TGGGGTCCCG GCGCGTTTTA GCGGCTCTGG
```

Figure 3C: V kappa 3 (Vκ3) gene sequence (continued)

```
CCGCGCTCGT CGGCACGTTG ACCCCAGGGC CGCGCAAAAT CGCCGAGACC
  S  G  T   D  F  T  L   T  I  S   S  L  E   P  E  D
                                             Eco57I
                                             ~~~~~~~
                                                BbsI
BamHI                                          ~~~~~~~
~~~~
ATCCGGCACG GATTTTACCC TGACCATTAG CAGCCTGGAA CCTGAAGACT
TAGGCCGTGC CTAAAATGGG ACTGGTAATC GTCGGACCTT GGACTTCTGA

 F  A  V  Y   Y  C  Q   Q  H  Y  T   T  P  P   T  F  G
                                                  MscI
                                                  ~~~~
TTGCGGTGTA TTATTGCCAG CAGCATTATA CCACCCCGCC GACCTTTGGC
AACGCCACAT AATAACGGTC GTCGTAATAT GGTGGGGCGG CTGGAAACCG

 Q  G  T  K   V  E  I   K  R  T
MscI                     BsiWI
~~                      ~~~~~~~
CAGGGTACGA AAGTTGAAAT TAAACGTACG
GTCCCATGCT TTCAACTTTA ATTTGCATGC
```

Figure 3D: V kappa 4 (Vκ4) gene sequence

```
 D   I   V   M    T   Q   S    P   D   S    L   A   V   S    L   G   E
 EcoRV                      BanII
~~~~~~                    ~~~~~~~~
GATATCGTGA TGACCCAGAG CCCGGATAGC CTGGCGGTGA GCCTGGGCGA
CTATAGCACT ACTGGGTCTC GGGCCTATCG GACCGCCACT CGGACCCGCT

  R   A   T   I   N   C   R    S   S   Q    S   V   L    Y   S   S
                     PstI
                   ~~~~~~~~
ACGTGCGACC ATTAACTGCA GAAGCAGCCA GAGCGTGCTG TATAGCAGCA
TGCACGCTGG TAATTGACGT CTTCGTCGGT CTCGCACGAC ATATCGTCGT

N   N   K   N    Y   L   A    W   Y   Q   Q    K   P   G    Q   P   P
                               KpnI             SexAI
                             ~~~~~~~          ~~~~~~~~~
ACAACAAAAA CTATCTGGCG TGGTACCAGC AGAAACCAGG TCAGCCGCCG
TGTTGTTTTT GATAGACCGC ACCATGGTCG TCTTTGGTCC AGTCGGCGGC

 K   L   L   I    Y   W   A    S   T   R    E   S   G   V    P   D   R
      AseI                                       SanDI
    ~~~~~~~~                                   ~~~~~~~~~
AAACTATTAA TTTATTGGGC ATCCACCCGT GAAAGCGGGG TCCCGGATCG
TTTGATAATT AAATAACCCG TAGGTGGGCA CTTTCGCCCC AGGGCCTAGC
```

Figure 3D: V kappa 4 (Vκ4) gene sequence (continued)

```
 F  S  G   S  G  S  G   T  D  F   T  L  T   I  S  S
              BamHI
             ~~~~~~~
TTTTAGCGGC TCTGGATCCG GCACTGATTT TACCCTGACC ATTTCGTCCC
AAAATCGCCG AGACCTAGGC CGTGACTAAA ATGGGACTGG TAAAGCAGGG

L  Q  A  E   D  V  A   V  Y  Y  C   Q  Q  H   Y  T  T
     Eco57I
     ~~~~~~~~
        BbsI
       ~~~~~~~~
TGCAAGCTGA AGACGTGGCG GTGTATTATT GCCAGCAGCA TTATACCACC
ACGTTCGACT TCTGCACCGC CACATAATAA CGGTCGTCGT AATATGGTGG

 P  P  T  F   G  Q  G   T  K  V   E  I  K  R   T
             MscI                              BsiWI
            ~~~~~~~                           ~~~~~~
CCGCCGACCT TTGGCCAGGG TACGAAAGTT GAAATTAAAC GTACG
GGCGGCTGGA AACCGGTCCC ATGCTTTCAA CTTTAATTTG CATGC
```

Figure 4A: V lambda 1 (Vλ1) gene sequence

```
 Q  S  V  L   T  Q  P   P  S  V   S  G  A  P   G  Q  R
                                            SexAI
                                          ~~~~~~~~~
CAGAGCGTGC TGACCCAGCC GCCTTCAGTG AGTGGCGCAC CAGGTCAGCG
GTCTCGCACG ACTGGGTCGG CGGAAGTCAC TCACCGCGTG GTCCAGTCGC
                         Eco57I
                         ~~~~~~~

 V  T  I   S  C  S  G   S  S  S   N  I  G   S  N  Y
          BssSI
         ~~~~~~~~
TGTGACCATC TCGTGTAGCG GCAGCAGCAG CAACATTGGC AGCAACTATG
ACACTGGTAG AGCACATCGC CGTCGTCGTC GTTGTAACCG TCGTTGATAC

V  S  W  Y   Q  Q  L   P  G  T  A   P  K  L   L  I  Y
     KpnI             XmaI    BbeI
    ~~~~~~~~         ~~~~~~~ ~~~~~~~~
TGAGCTGGTA CCAGCAGTTG CCCGGGACGG CGCCGAAACT GCTGATTTAT
ACTCGACCAT GGTCGTCAAC GGGCCCTGCC GCGGCTTTGA CGACTAAATA

 D  N  N  Q   R  P  S   G  V  P   D  R  F  S   G  S  K
              Bsu36I                             BamHI
             ~~~~~~~~~                          ~~~~~~
```

Figure 4A: V lambda 1 (Vλ1) gene sequence (continued)

```
GATAACAACC AGCGTCCCTC AGGCGTGCCG GATCGTTTTA GCGGATCCAA
CTATTGTTGG TCGCAGGGAG TCCGCACGGC CTAGCAAAAT CGCCTAGGTT

  S  G  T   S  A  S  L   A  I  T   G  L  Q   S  E  D
                                                BbsI
                                               ~~~~~~~
AAGCGGCACC AGCGCGAGCC TTGCGATTAC GGGCCTGCAA AGCGAAGACG
TTCGCCGTGG TCGCGCTCGG AACGCTAATG CCCGGACGTT TCGCTTCTGC

E  A  D  Y   Y  C  Q   Q  H  Y  T   T  P  P   V  F  G
AAGCGGATTA TTATTGCCAG CAGCATTATA CCACCCCGCC TGTGTTTGGC
TTCGCCTAAT AATAACGGTC GTCGTAATAT GGTGGGGCGG ACACAAACCG

 G  G  T  K   L  T  V   L  G
               HpaI       MscI
              ~~~~~~~     ~~~
GGCGGCACGA AGTTAACCGT TCTTGGC
CCGCCGTGCT TCAATTGGCA AGAACCG
```

Figure 4B: V lambda 2 (Vλ2) gene sequence

```
 Q  S  A  L   T  Q  P   A  S  V   S  G  S  P   G  Q  S
                                          SexAI
                                        ~~~~~~~~~
CAGAGCGCAC TGACCCAGCC AGCTTCAGTG AGCGGCTCAC CAGGTCAGAG
GTCTCGCGTG ACTGGGTCGG TCGAAGTCAC TCGCCGAGTG GTCCAGTCTC
                        Eco57I
                        ~~~~~~

  I  T  I   S  C  T  G   T  S  S   D  V  G   G  Y  N
           BssSI
         ~~~~~~~~
CATTACCATC TCGTGTACGG GTACTAGCAG CGATGTGGGC GGCTATAACT
GTAATGGTAG AGCACATGCC CATGATCGTC GCTACACCCG CCGATATTGA

Y  V  S  W   Y  Q  Q   H  P  G  K   A  P  K   L  M  I
           KpnI          XmaI      BbeI
         ~~~~~~~~      ~~~~~~    ~~~~~~
ATGTGAGCTG GTACCAGCAG CATCCCGGGA AGGCGCCGAA ACTGATGATT
TACACTCGAC CATGGTCGTC GTAGGGCCCT TCCGCGGCTT TGACTACTAA

 Y  D  V  S   N  R  P   S  G  V   S  N  R  F   S  G  S
                   Bsu36I                         BamHI
                  ~~~~~~~~~                       ~~~~~
TATGATGTGA GCAACCGTCC CTCAGGCGTG AGCAACCGTT TTAGCGGATC
ATACTACACT CGTTGGCAGG GAGTCCGCAC TCGTTGGCAA AATCGCCTAG
```

Figure 4B: V lambda 2 (Vλ2) gene sequence (continued)

```
  K   S   G    N   T   A   S    L   T   I    S   G   L    Q   A   E
BamHI                                                          BbsI
~                                                              ~~~~
CAAAAGCGGC AACACCGCGA GCCTGACCAT TAGCGGCCTG CAAGCGGAAG
GTTTTCGCCG TTGTGGCGCT CGGACTGGTA ATCGCCGGAC GTTCGCCTTC

D   E   A   D   Y   Y   C    Q   Q   H   Y    T   T   P    P   V   F
BbsI
~~
ACGAAGCGGA TTATTATTGC CAGCAGCATT ATACCACCCC GCCTGTGTTT
TGCTTCGCCT AATAATAACG GTCGTCGTAA TATGGTGGGG CGGACACAAA

 G   G   G   T    K   L   T    V   L   G
                   HpaI          MscI
                  ~~~~~~~        ~~~~
GGCGGCGGCA CGAAGTTAAC CGTTCTTGGC
CCGCCGCCGT GCTTCAATTG GCAAGAACCG
```

Figure 4C: V lambda 3 (Vλ3) gene sequence

```
 S  Y  E  L   T  Q  P   P  S  V   S  V  A  P   G  Q  T
                                            SexAI
                                           ~~~~~~~~~
AGCTATGAAC TGACCCAGCC GCCTTCAGTG AGCGTTGCAC CAGGTCAGAC
TCGATACTTG ACTGGGTCGG CGGAAGTCAC TCGCAACGTG GTCCAGTCTG
                        Eco57I
                        ~~~~~~

  A  R  I   S  C  S  G   D  A  L   G  D  K   Y  A  S
          BssSI
        ~~~~~~~~
CGCGCGTATC TCGTGTAGCG GCGATGCGCT GGGCGATAAA TACGCGAGCT
GCGCGCATAG AGCACATCGC CGCTACGCGA CCCGCTATTT ATGCGCTCGA

W  Y  Q  Q   K  P  G   Q  A  P  V   L  V  I   Y  D  D
 KpnI            XmaI     BbeI
~~~~~~        ~~~~~~   ~~~~~~
GGTACCAGCA GAAACCCGGG CAGGCGCCAG TTCTGGTGAT TTATGATGAT
CCATGGTCGT CTTTGGGCCC GTCCGCGGTC AAGACCACTA AATACTACTA
```

Figure 4C: V lambda 3 (Vλ3) gene sequence (continued)

```
 S  D  R  P   S  G  I   P  E  R   F  S  G  S   N  S  G
            Bsu36I                          BamHI
            ~~~~~~~~                      ~~~~~~~~~
TCTGACCGTC CCTCAGGCAT CCCGGAACGC TTTAGCGGAT CCAACAGCGG
AGACTGGCAG GGAGTCCGTA GGGCCTTGCG AAATCGCCTA GGTTGTCGCC

  N  T  A   T  L  T  I   S  G  T   Q  A  E   D  E  A
                                        BbsI
                                      ~~~~~~~~
CAACACCGCG ACCCTGACCA TTAGCGGCAC TCAGGCGGAA GACGAAGCGG
GTTGTGGCGC TGGGACTGGT AATCGCCGTG AGTCCGCCTT CTGCTTCGCC

D  Y  Y  C   Q  Q  H   Y  T  T  P   P  V  F   G  G  G
ATTATTATTG CCAGCAGCAT TATACCACCC CGCCTGTGTT TGGCGGCGGC
TAATAATAAC GGTCGTCGTA ATATGGTGGG GCGGACACAA ACCGCCGCCG

 T  K  L  T   V  L  G
     HpaI       MscI
   ~~~~~~~~     ~~~~
ACGAAGTTAA CCGTTCTTGG C
TGCTTCAATT GGCAAGAACC G
```

Figure 5A: V heavy chain 1A (VH1A) gene sequence

```
  Q  V  Q  L   V  Q  S   G  A  E   V  K  K  P   G  S  S
        MfeI
      ~~~~~~~~
CAGGTGCAAT TGGTTCAGTC TGGCGCGGAA GTGAAAAAAC CGGGCAGCAG
GTCCACGTTA ACCAAGTCAG ACCGCGCCTT CACTTTTTTG GCCCGTCGTC

   V  K  V   S  C  K  A   S  G  G   T  F  S   S  Y  A
                          BspEI
                         ~~~~~~~
CGTGAAAGTG AGCTGCAAAG CCTCCGGAGG CACTTTTAGC AGCTATGCGA
GCACTTTCAC TCGACGTTTC GGAGGCCTCC GTGAAAATCG TCGATACGCT

 I  S  W  V   R  Q  A   P  G  Q  G   L  E  W   M  G  G
                 BstXI               XhoI
             ~~~~~~~~~~~~~~        ~~~~~~~
TTAGCTGGGT GCGCCAAGCC CCTGGGCAGG GTCTCGAGTG GATGGGCGGC
AATCGACCCA CGCGGTTCGG GGACCCGTCC CAGAGCTCAC CTACCCGCCG

  I  I  P  I   F  G  T   A  N  Y   A  Q  K  F   Q  G  R
ATTATTCCGA TTTTTGGCAC GGCGAACTAC GCGCAGAAGT TTCAGGGCCG
TAATAAGGCT AAAAACCGTG CCGCTTGATG CGCGTCTTCA AAGTCCCGGC

   V  T  I   T  A  D  E   S  T  S   T  A  Y   M  E  L
 BstEII
```

Figure 5A: V heavy chain 1A (VH1A) gene sequence (continued)

```
~~~~~~~~
GGTGACCATT  ACCGCGGATG  AAAGCACCAG  CACCGCGTAT  ATGGAACTGA
CCACTGGTAA  TGGCGCCTAC  TTTCGTGGTC  GTGGCGCATA  TACCTTGACT

S   S   L   R    S   E   D    T   A   V   Y    Y   C   A    R   W   G
                               EagI                 BssHII
                             ~~~~~~~              ~~~~~~~~
GCAGCCTGCG  TAGCGAAGAT  ACGGCCGTGT  ATTATTGCGC  GCGTTGGGGC
CGTCGGACGC  ATCGCTTCTA  TGCCGGCACA  TAATAACGCG  CGCAACCCCG

 G   D   G   F    Y   A   M    D   Y   W    G   Q   G   T    L   V   T
                                               StyI
                                             ~~~~~~~
GGCGATGGCT  TTTATGCGAT  GGATTATTGG  GGCCAAGGCA  CCCTGGTGAC
CCGCTACCGA  AAATACGCTA  CCTAATAACC  CCGGTTCCGT  GGGACCACTG

  V   S   S
    BlpI
   ~~~~~~~
GGTTAGCTCA  G
CCAATCGAGT  C
```

Figure 5B: V heavy chain 1B (VH1B) gene sequence

```
 Q  V  Q  L   V  Q  S   G  A  E   V  K  K  P   G  A  S
       MfeI
      ~~~~~~~~
CAGGTGCAAT TGGTTCAGAG CGGCGCGGAA GTGAAAAAAC CGGGCGCGAG
GTCCACGTTA ACCAAGTCTC GCCGCGCCTT CACTTTTTTG GCCCGCGCTC

  V  K  V   S  C  K  A   S  G  Y   T  F  T   S  Y  Y
                           BspEI
                          ~~~~~~~
CGTGAAAGTG AGCTGCAAAG CCTCCGGATA TACCTTTACC AGCTATTATA
GCACTTTCAC TCGACGTTTC GGAGGCCTAT ATGGAAATGG TCGATAATAT

M  H  W  V   R  Q  A   P  G  Q  G   L  E  W   M  G  W
                 BstXI             XhoI
            ~~~~~~~~~~~~~~~       ~~~~~~~
TGCACTGGGT CCGCCAAGCC CCTGGGCAGG GTCTCGAGTG GATGGCTGG
ACGTGACCCA GGCGGTTCGG GGACCCGTCC CAGAGCTCAC CTACCCGACC

 I  N  P  N   S  G  G   T  N  Y   A  Q  K  F   Q  G  R
ATTAACCCGA ATAGCGGCGG CACGAACTAC GCGCAGAAGT TTCAGGGCCG
TAATTGGGCT TATCGCCGCC GTGCTTGATG CGCGTCTTCA AAGTCCCGGC
```

Figure 5B: V heavy chain 1B (VH1B) gene sequence (continued)

```
  V  T  M   T  R  D  T   S  I  S   T  A  Y   M  E  L
BstEII
~~~~~~~~
GGTGACCATG ACCCGTGATA CCAGCATTAG CACCGCGTAT ATGGAACTGA
CCACTGGTAC TGGGCACTAT GGTCGTAATC GTGGCGCATA TACCTTGACT

S  S  L  R   S  E  D   T  A  V  Y   Y  C  A   R  W  G
                        EagI             BssHII
                       ~~~~~~            ~~~~~~~~
GCAGCCTGCG TAGCGAAGAT ACGGCCGTGT ATTATTGCGC GCGTTGGGGC
CGTCGGACGC ATCGCTTCTA TGCCGGCACA TAATAACGCG CGCAACCCCG

 G  D  G  F   Y  A  M   D  Y  W   G  Q  G  T   L  V  T
                                     StyI
                                   ~~~~~~
GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

  V  S  S
     BlpI
    ~~~~~~
GGTTAGCTCA G
CCAATCGAGT C
```

Figure 5C: V heavy chain 2 (VH2) gene sequence

```
 Q   V   Q   L    K   E   S    G   P   A    L   V   K   P    T   Q   T
       MfeI
      ~~~~~~~~
CAGGTGCAAT TGAAAGAAAG CGGCCCGGCC CTGGTGAAAC CGACCCAAAC
GTCCACGTTA ACTTTCTTTC GCCGGGCCGG GACCACTTTG GCTGGGTTTG

  L   T   L    T   C   T   F    S   G   F    S   L   S    T   S   G
                               BspEI
                              ~~~~~~
CCTGACCCTG ACCTGTACCT TTTCCGGATT TAGCCTGTCC ACGTCTGGCG
GGACTGGGAC TGGACATGGA AAAGGCCTAA ATCGGACAGG TGCAGACCGC

V   G   V   G    W   I   R    Q   P   P   G    K   A   L    E   W   L
                               BstXI                XhoI
                          ~~~~~~~~~~~~~~~        ~~~~~~~~
TTGGCGTGGG CTGGATTCGC CAGCCGCCTG GGAAAGCCCT CGAGTGGCTG
AACCGCACCC GACCTAAGCG GTCGGCGGAC CCTTTCGGGA GCTCACCGAC

 A   L   I   D    W   D   D    D   K   Y    Y   S   T   S    L   K   T
                                                               MluI
                                                                 ~~
GCTCTGATTG ATTGGGATGA TGATAAGTAT TATAGCACCA GCCTGAAAAC
CGAGACTAAC TAACCCTACT ACTATTCATA ATATCGTGGT CGGACTTTTG
```

Figure 5C: V heavy chain 2 (VH2) gene sequence (continued)

```
  R   L   T    I   S   K   D    T   S   K    N   Q   V    V   L   T
MluI                           NspV
~~~~                          ~~~~~~~
GCGTCTGACC ATTAGCAAAG ATACTTCGAA AAATCAGGTG GTGCTGACTA
CGCAGACTGG TAATCGTTTC TATGAAGCTT TTTAGTCCAC CACGACTGAT

M   T   N   M    D   P   V    D   T   A   T    Y   Y   C    A   R   W
                                                    BssHII
                                                   ~~~~~~~~
TGACCAACAT GGACCCGGTG GATACGGCCA CCTATTATTG CGCGCGTTGG
ACTGGTTGTA CCTGGGCCAC CTATGCCGGT GGATAATAAC GCGCGCAACC

 G   G   D   G    F   Y   A    M   D   Y    W   G   Q   G    T   L   V
                                                StyI
                                              ~~~~~~~~
GGCGGCGATG GCTTTTATGC GATGGATTAT TGGGGCCAAG GCACCCTGGT
CCGCCGCTAC CGAAAATACG CTACCTAATA ACCCCGGTTC CGTGGGACCA

  T   V   S    S
         BlpI
        ~~~~~~~
GACGGTTAGC TCAG
CTGCCAATCG AGTC
```

Figure 5D: V heavy chain 3 (VH3) gene sequence

```
 E  V  Q  L   V  E  S   G  G  G   L  V  Q  P   G  G  S
       MfeI
      ~~~~~~~~
GAAGTGCAAT TGGTGGAAAG CGGCGGCGGC CTGGTGCAAC CGGGCGGCAG
CTTCACGTTA ACCACCTTTC GCCGCCGCCG GACCACGTTG GCCCGCCGTC

  L  R  L   S  C  A  A   S  G  F   T  F  S   S  Y  A
                        BspEI
                        ~~~~~~
CCTGCGTCTG AGCTGCGCGG CCTCCGGATT TACCTTTAGC AGCTATGCGA
GGACGCAGAC TCGACGCGCC GGAGGCCTAA ATGGAAATCG TCGATACGCT

M  S  W  V   R  Q  A   P  G  K  G   L  E  W   V  S  A
                BstXI                XhoI
          ~~~~~~~~~~~~~~          ~~~~~~
TGAGCTGGGT GCGCCAAGCC CCTGGGAAGG GTCTCGAGTG GGTGAGCGCG
ACTCGACCCA CGCGGTTCGG GGACCCTTCC CAGAGCTCAC CCACTCGCGC

 I  S  G  S   G  G  S   T  Y  Y   A  D  S  V   K  G  R
ATTAGCGGTA GCGGCGGCAG CACCTATTAT GCGGATAGCG TGAAAGGCCG
TAATCGCCAT CGCCGCCGTC GTGGATAATA CGCCTATCGC ACTTTCCGGC
```

Figure 5D: V heavy chain 3 (VH3) gene sequence (continued)

```
 F  T  I   S  R  D  N   S  K  N   T  L  Y   L  Q  M
            PmlI         NspV
           ~~~~~~       ~~~~~~
TTTTACCATT TCACGTGATA ATTCGAAAAA CACCCTGTAT CTGCAAATGA
AAAATGGTAA AGTGCACTAT TAAGCTTTTT GTGGGACATA GACGTTTACT

N  S  L  R   A  E  D   T  A  V  Y   Y  C  A   R  W  G
                        EagI            BssHII
                       ~~~~~~          ~~~~~~~
ACAGCCTGCG TGCGGAAGAT ACGGCCGTGT ATTATTGCGC GCGTTGGGGC
TGTCGGACGC ACGCCTTCTA TGCCGGCACA TAATAACGCG CGCAACCCCG

 G  D  G  F   Y  A  M   D  Y  W   G  Q  G  T   L  V  T
                                     StyI
                                    ~~~~~~
GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

 V  S  S
     BlpI
    ~~~~~~
GGTTAGCTCA G
CCAATCGAGT C
```

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Figure 5E: V heavy chain 4 (VH4) gene sequence

```
 Q  V  Q  L   Q  E  S   G  P  G   L  V  K  P   S  E  T
       MfeI
     ~~~~~~~~
CAGGTGCAAT TGCAAGAAAG TGGTCCGGGC CTGGTGAAAC CGAGCGAAAC
GTCCACGTTA ACGTTCTTTC ACCAGGCCCG GACCACTTTG GCTCGCTTTG

  L  S  L   T  C  T  V   S  G  G   S  I  S   S  Y  Y
                          BspEI
                         ~~~~~~~
CCTGAGCCTG ACCTGCACCG TTTCCGGAGG CAGCATTAGC AGCTATTATT
GGACTCGGAC TGGACGTGGC AAAGGCCTCC GTCGTAATCG TCGATAATAA

W  S  W  I   R  Q  P   P  G  K  G   L  E  W   I  G  Y
                BstXI               XhoI
             ~~~~~~~~~~~~~~       ~~~~~~~
GGAGCTGGAT TCGCCAGCCG CCTGGGAAGG GTCTCGAGTG GATTGGCTAT
CCTCGACCTA AGCGGTCGGC GGACCCTTCC CAGAGCTCAC CTAACCGATA

 I  Y  Y  S   G  S  T   N  Y  N   P  S  L  K   S  R  V
                                                BstEII
                                                   ~~~
ATTTATTATA GCGGCAGCAC CAACTATAAT CCGAGCCTGA AAAGCCGGGT
TAAATAATAT CGCCGTCGTG GTTGATATTA GGCTCGGACT TTTCGGCCCA
```

Figure 5E: V heavy chain 4 (VH4) gene sequence (continued)

```
  T  I  S   V  D  T  S   K  N  Q   F  S  L   K  L  S
BstEII                NspV
~~~~                  ~~~~~~~~~
GACCATTAGC GTTGATACTT CGAAAAACCA GTTTAGCCTG AAACTGAGCA
CTGGTAATCG CAACTATGAA GCTTTTTGGT CAAATCGGAC TTTGACTCGT

S  V  T  A   A  D  T   A  V  Y  Y   C  A  R   W  G  G
                      EagI             BssHII
                      ~~~~~~~~         ~~~~~~~
GCGTGACGGC GGCGGATACG GCCGTGTATT ATTGCGCGCG TTGGGGCGGC
CGCACTGCCG CCGCCTATGC CGGCACATAA TAACGCGCGC AACCCCGCCG

 D  G  F  Y   A  M  D   Y  W  G   Q  G  T  L   V  T  V
                                 StyI
                               ~~~~~~~~
GATGGCTTTT ATGCGATGGA TTATTGGGGC CAAGGCACCC TGGTGACGGT
CTACCGAAAA TACGCTACCT AATAACCCCG GTTCCGTGGG ACCACTGCCA

  S  S
   BlpI
  ~~~~~~
TAGCTCAG
ATCGAGTC
```

Figure 5F: V heavy chain 5 (VH5) gene sequence

```
 E  V  Q  L   V  Q  S   G  A  E   V  K  K  P   G  E  S
       MfeI
      ~~~~~~~~
GAAGTGCAAT TGGTTCAGAG CGGCGCGGAA GTGAAAAAAC CGGGCGAAAG
CTTCACGTTA ACCAAGTCTC GCCGCGCCTT CACTTTTTTG GCCCGCTTTC

  L  K  I   S  C  K  G   S  G  Y   S  F  T   S  Y  W
                         BspEI
                        ~~~~~~~
CCTGAAAATT AGCTGCAAAG GTTCCGGATA TTCCTTTACG AGCTATTGGA
GGACTTTTAA TCGACGTTTC CAAGGCCTAT AAGGAAATGC TCGATAACCT

 I  G  W  V   R  Q  M   P  G  K  G   L  E  W   M  G  I
                BstXI                XhoI
             ~~~~~~~~~~~~~~        ~~~~~~
TTGGCTGGGT GCGCCAGATG CCTGGGAAGG GTCTCGAGTG GATGGGCATT
AACCGACCCA CGCGGTCTAC GGACCCTTCC CAGAGCTCAC CTACCCGTAA

  I  Y  P  G   D  S  D   T  R  Y   S  P  S  F   Q  G  Q
ATTTATCCGG GCGATAGCGA TACCCGTTAT TCTCCGAGCT TTCAGGGCCA
TAAATAGGCC CGCTATCGCT ATGGGCAATA AGAGGCTCGA AAGTCCCGGT
```

Figure 5F: V heavy chain 5 (VH5) gene sequence (continued)

```
   V   T   I    S   A   D   K    S   I   S    T   A   Y    L   Q   W
 BstEII
 ~~~~~~~~
 GGTGACCATT AGCGCGGATA AAAGCATTAG CACCGCGTAT CTTCAATGGA
 CCACTGGTAA TCGCGCCTAT TTTCGTAATC GTGGCGCATA GAAGTTACCT

 S   S   L   K    A   S   D    T   A   M   Y    Y   C   A    R   W   G
                                                  BssHII
                                                  ~~~~~~~~
 GCAGCCTGAA AGCGAGCGAT ACGGCCATGT ATTATTGCGC GCGTTGGGGC
 CGTCGGACTT TCGCTCGCTA TGCCGGTACA TAATAACGCG CGCAACCCCG

  G   D   G   F    Y   A   M    D   Y   W    G   Q   G   T    L   V   T
                                               StyI
                                              ~~~~~~~
 GGCGATGGCT TTTATGCGAT GGATTATTGG GGCCAAGGCA CCCTGGTGAC
 CCGCTACCGA AAATACGCTA CCTAATAACC CCGGTTCCGT GGGACCACTG

   V   S   S
       BlpI
      ~~~~~~~
 GGTTAGCTCA G
 CCAATCGAGT C
```

Figure 5G: V heavy chain 6 (VH6) gene sequence

```
  Q  V  Q  L   Q  Q  S   G  P  G   L  V  K  P   S  Q  T
       MfeI
      ~~~~~~~~
CAGGTGCAAT TGCAACAGTC TGGTCCGGGC CTGGTGAAAC CGAGCCAAAC
GTCCACGTTA ACGTTGTCAG ACCAGGCCCG GACCACTTTG GCTCGGTTTG

  L  S  L  T  C  A  I   S  G  D   S  V  S   S  N  S
                        BspEI
                       ~~~~~~
CCTGAGCCTG ACCTGTGCGA TTTCCGGAGA TAGCGTGAGC AGCAACAGCG
GGACTCGGAC TGGACACGCT AAAGGCCTCT ATCGCACTCG TCGTTGTCGC

A  A  W  N   W  I  R   Q  S  P  G   R  G  L   E  W  L
                        BstXI            XhoI
                  ~~~~~~~~~~~~~~~       ~~~~~~~~
CGGCGTGGAA CTGGATTCGC CAGTCTCCTG GGCGTGGCCT CGAGTGGCTG
GCCGCACCTT GACCTAAGCG GTCAGAGGAC CCGCACCGGA GCTCACCGAC

 G  R  T  Y   Y  R  S   K  W  Y   N  D  Y  A   V  S  V
GGCCGTACCT ATTATCGTAG CAAATGGTAT AACGATTATG CGGTGAGCGT
CCGGCATGGA TAATAGCATC GTTTACCATA TTGCTAATAC GCCACTCGCA
```

Figure 5G: V heavy chain 6 (VH6) gene sequence (continued)

```
   K  S  R   I  T  I  N   P  D  T   S  K  N   Q  F  S
             BsaBI                  NspV
          ~~~~~~~~~~~~~           ~~~~~~~
GAAAAGCCGG ATTACCATCA ACCCGGATAC TTCGAAAAAC CAGTTTAGCC
CTTTTCGGCC TAATGGTAGT TGGGCCTATG AAGCTTTTTG GTCAAATCGG

L  Q  L  N   S  V  T   P  E  D  T   A  V  Y   Y  C  A
                                    EagI         BssHII
                                  ~~~~~~~          ~~~~~
TGCAACTGAA CAGCGTGACC CCGGAAGATA CGGCCGTGTA TTATTGCGCG
ACGTTGACTT GTCGCACTGG GGCCTTCTAT GCCGGCACAT AATAACGCGC

 R  W  G  G   D  G  F   Y  A  M   D  Y  W  G   Q  G  T
BssHII                                         StyI
~                                             ~~~~~~~
CGTTGGGGCG GCGATGGCTT TTATGCGATG GATTATTGGG GCCAAGGCAC
GCAACCCCGC CGCTACCGAA AATACGCTAC CTAATAACCC CGGTTCCGTG

   L  V  T   V  S  S
              BlpI
            ~~~~~~~
CCTGGTGACG GTTAGCTCAG
GGACCACTGC CAATCGAGTC
```

Figure 6: oligonucleotides for gene synthesis

O1K1 5'- GAATGCATACGCTGATATCCAGATGACCCAGAG-CCCGTCTAGCCTGAGC -3'

O1K2 5'- CGCTCTGCAGGTAATGGTCACACGATCACCCAC-GCTCGCGCTCAGGCTAGACGGGC -3'

O1K3 5'- GACCATTACCTGCAGAGCGAGCCAGGGCATTAG-CAGCTATCTGGCGTGGTACCAGCAG -3'

O1K4 5'- CTTTGCAAGCTGCTGGCTGCATAAATTAATAGT-TTCGGTGCTTTACCTGGTTTCTGCTGGTACCACGCCAG -3'

O1K5 5'- CAGCCAGCAGCTTGCAAAGCGGGGTCCCGTCCC-GTTTTAGCGGCTCTGGATCCGGCACTGATTTTAC -3'

O1K6 5'- GATAATAGGTCGCAAAGTCTTCAGGTTGCAGGC-TGCTAATGGTCAGGGTAAAATCAGTGCCGGATCC -3'

O2K1 5'- CGATATCGTGATGACCCAGAGCCCACTGAGCCT-GCCAGTGACTCCGGGCGAGCC -3'

O2K2 5'- GCCGTTGCTATGCAGCAGGCTTTGGCTGCTTCT-GCAGCTAATGCTCGCAGGCTCGCCCGGAGTCAC -3'

O2K3 5'- CTGCTGCATAGCAACGGCTATAACTATCTGGAT-TGGTACCTTCAAAAACCAGGTCAAAGCCC -3'

O2K4 5'- CGATCCGGGACCCCACTGGCACGGTTGCTGCCC-AGATAAATTAATAGCTGCGGGCTTTGACCTGGTTTTTG -3'

O2K5 5'- AGTGGGGTCCCGGATCGTTTTAGCGGCTCTGGA-TCCGGCACCGATTTTACCCTGAAAATTAGCCGTGTG -3'

O2K6 5'- CCATGCAATAATACACGCCCACGTCTTCAGCTT-CCACACGGCTAATTTTCAGGG -3'

O3K1 5'- GAATGCATACGCTGATATCGTGCTGACCCAGAG-CCCGG -3'

O3K2 5'- CGCTCTGCAGCTCAGGGTCGCACGTTCGCCCGG-AGACAGGCTCAGGGTCGCCGGGCTCTGGGTCAGC -3'

O3K3 5'- CCCTGAGCTGCAGAGCGAGCCAGAGCGTGAGCA-GCAGCTATCTGGCGTGGTACCAG -3'

Figure 6: (continued)

O3K4 5'- GCACGGCTGCTCGCGCCATAAATTAATAGACGC-
GGTGCTTGACCTGGTTTCTGCTGGTACCACGCCAGATAG -3'

O3K5 5'- GCGCGAGCAGCCGTGCAACTGGGGTCCCGGCGC-
GTTTTAGCGGCTCTGGATCCGGCACGGATTTTAC -3'

O3K6 5'- GATAATACACCGCAAAGTCTTCAGGTTCCAGGC-
TGCTAATGGTCAGGGTAAAATCCGTGCCGGATC -3'

O4K1 5'- GAATGCATACGCTGATATCGTGATGACCCAGAG-
CCCGGATAGCCTGGCG -3'

O4K2 5'- GCTTCTGCAGTTAATGGTCGCACGTTCGCCCAG-
GCTCACCGCCAGGCTATCCGGGC -3'

O4K3 5'- CGACCATTAACTGCAGAAGCAGCCAGAGCGTGC-
TGTATAGCAGCAACAACAAAAACTATCTGGCGTGGTACCAG -
3'

O4K4 5'- GATGCCCAATAAATTAATAGTTTCGGCGGCTGA-
CCTGGTTTCTGCTGGTACCACGCCAGATAG -3'

O4K5 5'- AAACTATTAATTTATTGGGCATCCACCCGTGAA-
AGCGGGGTCCCGGATCGTTTTAGCGGCTCTGGATCCGGCAC-
3'

O4K6 5'- GATAATACACCGCCACGTCTTCAGCTTGCAGGG-
ACGAAATGGTCAGGGTAAAATCAGTGCCGGATCCAGAGCC -
3'

O1L1 5'- GAATGCATACGCTCAGAGCGTGCTGACCCAGCC-
GCCTTCAGTGAGTGG -3'

O1L2 5'- CAATGTTGCTGCTGCTGCCGCTACACGAGATGG-
TCACACGCTGACCTGGTGCGCCACTCACTGAAGGCGGC -3'

O1L3 5'- GGCAGCAGCAGCAACATTGGCAGCAACTATGTG-
AGCTGGTACCAGCAGTTGCCCGGGAC -3'

O1L4 5'- CCGGCACGCCTGAGGGACGCTGGTTGTTATCAT-
AAATCAGCAGTTTCGGCGCCGTCCCGGGCAACTGC -3'

O1L5 5'- CCCTCAGGCGTGCCGGATCGTTTTAGCGGATCC-
AAAAGCGGCACCAGCGCGAGCCTTGCG -3'

Figure 6: (continued)

O1L6 5'- CCGCTTCGTCTTCGCTTTGCAGGCCCGTAATCG-
CAAGGCTCGCGCTGG -3'

O2L1 5'- GAATGCATACGCTCAGAGCGCACTGACCCAGCC-
AGCTTCAGTGAGCGGC -3'

O2L2 5'- CGCTGCTAGTACCCGTACACGAGATGGTAATGC-
TCTGACCTGGTGAGCCGCTCACTGAAGCTGG -3'

O2L3 5'- GTACGGGTACTAGCAGCGATGTGGGCGGCTATA-
ACTATGTGAGCTGGTACCAGCAGCATCCCGG -3'

O2L4 5'- CGCCTGAGGGACGGTTGCTCACATCATAAATCA-
TCAGTTTCGGCGCCTTCCCGGGATGCTGCTGGTAC -3'

O2L5 5'- CAACCGTCCCTCAGGCGTGAGCAACCGTTTTAG-
CGGATCCAAAAGCGGCAACACCGCGAGCC -3'

O2L6 5'- CCGCTTCGTCTTCCGCTTGCAGGCCGCTAATGG-
TCAGGCTCGCGGTGTTGCCG -3'

O3L1 5'- GAATGCATACGCTAGCTATGAACTGACCCAGCC-
GCCTTCAGTGAGCG -3'

O3L2 5'- CGCCCAGCGCATCGCCGCTACACGAGATACGCG-
CGGTCTGACCTGGTGCAACGCTCACTGAAGGCGGC -3'

O3L3 5'- GGCGATGCGCTGGGCGATAAATACGCGAGCTGG-
TACCAGCAGAAACCCGGGCAGGCGC -3'

O3L4 5'- GCGTTCCGGGATGCCTGAGGGACGGTCAGAATC-
ATCATAAATCACCAGAACTGGCGCCTGCCCGGGTTTC -3'

O3L5 5'- CAGGCATCCCGGAACGCTTTAGCGGATCCAACA-
GCGGCAACACCGCGACCCTGACCATTAGCGG -3'

O3L6 5'- CCGCTTCGTCTTCCGCCTGAGTGCCGCTAATGG-
TCAGGGTC -3'

O1246H1 5'- GCTCTTCACCCCTGTTACCAAAGCCCAG-
GTGCAATTG -3'

O1AH2 5'- GGCTTTGCAGCTCACTTTCACGCTGCTGCCCGG-
TTTTTTCACTTCCGCGCCAGACTGAACCAATTGCACCTGGGC-
TTTG -3'

Figure 6: (continued)

O1AH3 5'- GAAAGTGAGCTGCAAAGCCTCCGGAGGCACTTT-
TAGCAGCTATGCGATTAGCTGGGTGCGCCAAGCCCCTGGGCAG
GGTC -3'

O1AH4 5'- GCCCTGAAACTTCTGCGCGTAGTTCGCCGTGCC-
AAAAATCGGAATAATGCCGCCCATCCACTCGAGACCCTGCCC-
AGGGGC -3'

O1AH5 5'- GCGCAGAAGTTTCAGGGCCGGGTGACCATTACC-
GCGGATGAAAGCACCAGCACCGCGTATATGGAACTGAGCAGCC
TGCG -3'

O1ABH6 5'- GCGCGCAATAATACACGGCCGTATCTTCGCT-
ACGCAGGCTGCTCAGTTCC -3'

O1BH2 5'- GGCTTTGCAGCTCACTTTCACGCTCGCGCCCGG-
TTTTTTCACTTCCGCGCCGCTCTGAACCAATTGCACCTGGGC-
TTTG -3'

O1BH3 5'- GAAAGTGAGCTGCAAAGCCTCCGGATATACCTT-
TACCAGCTATTATATGCACTGGGTCCGCCAAGCCCCTGGGCAG
GGTC -3'

O1BH4 5'- GCCCTGAAACTTCTGCGCGTAGTTCGTGCCGCC-
GCTATTCGGGTTAATCCAGCCCATCCACTCGAGACCCTGCCCA
GGGGC -3'

O1BH5 5'- GCGCAGAAGTTTCAGGGCCGGGTGACCATGACC-
CGTGATACCAGCATTAGCACCGCGTATATGGAACTGAGCAGCC
TGCG -3'

O2H2 5'- GGTACAGGTCAGGGTCAGGGTTTGGGTCGGTTT-
CACCAGGGCCGGGCCGCTTTCTTTCAATTGCACCTGGGCTTTG
-3'

O2H3 5'- CTGACCCTGACCTGTACCTTTTCCGGATTTAGC-
CTGTCCACGTCTGGCGTTGGCGTGGGCTGGATTCGCCAGCCGC
CTGGGAAAG -3'

O2H4 5'- GCGTTTTCAGGCTGGTGCTATAATACTTATCAT-
CATCCCAATCAATCAGAGCCAGCCACTCGAGGGCTTTCCCAGG
CGGCTGG -3'

Figure 6: (continued)

O2H5 5'- GCACCAGCCTGAAAACGCGTCTGACCATTAGCA-AAGATACTTCGAAAAATCAGGTGGTGCTGACTATGACCAACATGG -3'

O2H6 5'- GCGCGCAATAATAGGTGGCCGTATCCACCGGGT-CCATGTTGGTCATAGTCAGC -3'

O3H1 5'- CGAAGTGCAATTGGTGGAAAGCGGCGGCGGCCT-GGTGCAACCGGGCGGCAG -3'

O3H2 5'- CATAGCTGCTAAAGGTAAATCCGGAGGCCGCGC-AGCTCAGACGCAGGCTGCCGCCCGGTTGCAC -3'

O3H3 5'- GATTTACCTTTAGCAGCTATGCGATGAGCTGGG-TGCGCCAAGCCCCTGGGAAGGGTCTCGAGTGGGTGAG -3'

O3H4 5'- GGCCTTTCACGCTATCCGCATAATAGGTGCTGC-CGCCGCTACCGCTAATCGCGCTCACCCACTCGAGACCC -3'

O3H5 5'- CGGATAGCGTGAAAGGCCGTTTTACCATTTCAC-GTGATAATTCGAAAAACACCCTGTATCTGCAAATGAACAG-3'

O3H6 5'- CACGCGCGCAATAATACACGGCCGTATCTTCCG-CACGCAGGCTGTTCATTTGCAGATACAGG -3'

O4H2 5'- GGTCAGGCTCAGGGTTTCGCTCGGTTTCACCAG-GCCCGGACCACTTTCTTGCAATTGCACCTGGGCTTTG -3'

O4H3 5'- GAAACCCTGAGCCTGACCTGCACCGTTTCCGGA-GGCAGCATTAGCAGCTATTATTGGAGCTGGATTCGCCAGCCGC -3'

O4H4 5'- GATTATAGTTGGTGCTGCCGCTATAATAAATAT-AGCCAATCCACTCGAGACCCTTCCCAGGCGGCTGGCGAATCCAG -3'

O4H5 5'- CGGCAGCACCAACTATAATCCGAGCCTGAAAAG-CCGGGTGACCATTAGCGTTGATACTTCGAAAAACCAGTTTAGCCTG -3'

O4H6 5'- GCGCGCAATAATACACGGCCGTATCCGCCGCCG-TCACGCTGCTCAGTTTCAGGCTAAACTGGTTTTTCG -3'

Figure 6: (continued)

O5H1 5'- GCTCTTCACCCCTGTTACCAAAGCCGAAGTGCA-
ATTG -3'

O5H2 5'- CCTTTGCAGCTAATTTTCAGGCTTTCGCCCGGT-
TTTTTCACTTCCGCGCCGCTCTGAACCAATTGCACTTCGGCTT
TGG -3'

O5H3 5'- CCTGAAAATTAGCTGCAAAGGTTCCGGATATTC-
CTTTACGAGCTATTGGATTGGCTGGGTGCGCCAGATGCCTGG
-3'

O5H4 5'- CGGAGAATAACGGGTATCGCTATCGCCCGGATA-
AATAATGCCCATCCACTCGAGACCCTTCCCAGGCATCTGGCGC
AC -3'

O5H5 5'- CGATACCCGTTATTCTCCGAGCTTTCAGGGCCA-
GGTGACCATTAGCGCGGATAAAAGCATTAGCACCGCGTATCTT
C -3'

O5H6 5'- GCGCGCAATAATACATGGCCGTATCGCTCGCTT-
TCAGGCTGCTCCATTGAAGATACGCGGTGCTAATG -3'

O6H2 5'- GAAATCGCACAGGTCAGGCTCAGGGTTTGGCTC-
GGTTTCACCAGGCCCGGACCAGACTGTTGCAATTGCACCTGG-
GCTTTG -3'

O6H3 5'- GCCTGACCTGTGCGATTTCCGGAGATAGCGTGA-
GCAGCAACAGCGCGGCGTGGAACTGGATTCGCCAGTCTCCTGG
GCG -3'

O6H4 5'- CACCGCATAATCGTTATACCATTTGCTACGATA-
ATAGGTACGGCCCAGCCACTCGAGGCCACGCCCAGGAGACTG-
GCG -3'

O6H5 5'- GGTATAACGATTATGCGGTGAGCGTGAAAAGCC-
GGATTACCATCAACCCGGATACTTCGAAAAACCAGTTTAGCCT
GC -3'

O6H6 5'- GCGCGCAATAATACACGGCCGTATCTTCCGGGG-
TCACGCTGTTCAGTTGCAGGCTAAACTGGTTTTTC -3'

OCLK1 5'- GGCTGAAGACGTGGGCGTGTATTATTGCCAGCA-
GCATTATACCACCCCGCCGACCTTTGGCCAGGGTAC -3'

Figure 6: (continued)

OCLK2 5'- GCGGAAAAATAAACACGCTCGGAGCAGCCACCG-TACGTTTAATTTCAACTTTCGTACCCTGGCCAAAGGTC -3'

OCLK3 5'- GAGCGTGTTTATTTTTCCGCCGAGCGATGAACA-ACTGAAAAGCGGCACGGCGAGCGTGGTGTGCCTGCTG -3'

OCLK4 5'- CAGCGCGTTGTCTACTTTCCACTGAACTTTCGC-TTCACGCGGATAAAAGTTGTTCAGCAGGCACACCACGC -3'

OCLK5 5'- GAAAGTAGACAACGCGCTGCAAAGCGGCAACAG-CCAGGAAAGCGTGACCGAACAGGATAGCAAAGATAG -3'

OCLK6 5'- GTTTTTCATAATCCGCTTTGCTCAGGGTCAGGG-TGCTGCTCAGAGAATAGGTGCTATCTTTGCTATCCTGTTCG -3'

OCLK7 5'- GCAAAGCGGATTATGAAAAACATAAAGTGTATG-CGTGCGAAGTGACCCATCAAGGTCTGAGCAGCCCGGTG -3'

OCLK8 5'- GGCATGCTTATCAGGCCTCGCCACGATTAAAAG-ATTTAGTCACCGGGCTGCTCAGAC -3'

OCH1 5'- GGCGTCTAGAGGCCAAGGCACCCTGGTGACGGT-TAGCTCAGCGTCGAC -3'

OCH2 5'- GTGCTTTTGCTGCTCGGAGCCAGCGGAAACACG-CTTGGACCTTTGGTCGACGCTGAGCTAACC -3'

OCH3 5'- CTCCGAGCAGCAAAAGCACCAGCGGCGGCACGG-CTGCCCTGGGCTGCCTGGTTAAAGATTATTTCC -3'

OCH4 5'- CTGGTCAGCGCCCCGCTGTTCCAGCTCACGGTG-ACTGGTTCCGGGAAATAATCTTTAACCAGGCA -3'

OCH5 5'- AGCGGGGCGCTGACCAGCGGCGTGCATACCTTT-CCGGCGGTGCTGCAAAGCAGCGGCCTG -3'

OCH6 5'- GTGCCTAAGCTGCTGCTCGGCACGGTCACAACG-CTGCTCAGGCTATACAGGCCGCTGCTTTGCAG -3'

OCH7 5'- GAGCAGCAGCTTAGGCACTCAGACCTATATTTG-CAACGTGAACCATAAACCGAGCAACACC -3'

OCH8 5'- GCGCGAATTCGCTTTTCGGTTCCACTTTTTTAT-CCACTTTGGTGTTGCTCGGTTTATGG -3'

Figure 7A: sequence of the synthetic Cκ gene segment

```
      V  A   A  P  S   V  F  I   F  P  P  S   D  E  Q
 BsiWI
------
CGTACGGTGG CTGCTCCGAG CGTGTTTATT TTTCCGCCGA GCGATGAACA
GCATGCCACC GACGAGGCTC GCACAAATAA AAAGGCGGCT CGCTACTTGT

  L  K  S   G  T  A  S   V  V  C   L  L  N   N  F  Y
ACTGAAAAGC GGCACGGCGA GCGTGGTGTG CCTGCTGAAC AACTTTTATC
TGACTTTTCG CCGTGCCGCT CGCACCACAC GGACGACTTG TTGAAAATAG

P  R  E  A   K  V  Q   W  K  V  D   N  A  L   Q  S  G
CGCGTGAAGC GAAAGTTCAG TGGAAAGTAG ACAACGCGCT GCAAAGCGGC
GCGCACTTCG CTTTCAAGTC ACCTTTCATC TGTTGCGCGA CGTTTCGCCG

 N  S  Q  E   S  V  T   E  Q  D   S  K  D  S   T  Y  S
AACAGCCAGG AAAGCGTGAC CGAACAGGAT AGCAAAGATA GCACCTATTC
TTGTCGGTCC TTTCGCACTG GCTTGTCCTA TCGTTTCTAT CGTGGATAAG

  L  S  S   T  L  T  L   S  K  A   D  Y  E   K  H  K
TCTGAGCAGC ACCCTGACCC TGAGCAAAGC GGATTATGAA AAACATAAAG
AGACTCGTCG TGGGACTGGG ACTCGTTTCG CCTAATACTT TTTGTATTTC
```

Figure 7A: sequence of the synthetic Cκ gene segment (continued)

```
V  Y  A  C   E  V  T   H  Q  G  L   S  S  P   V  T  K
TGTATGCGTG CGAAGTGACC CATCAAGGTC TGAGCAGCCC GGTGACTAAA
ACATACGCAC GCTTCACTGG GTAGTTCCAG ACTCGTCGGG CCACTGATTT

 S  F  N  R   G  E  A  *
                 StuI         SphI
               ~~~~~~~~     ~~~~~~
TCTTTTAATC GTGGCGAGGC CTGATAAGCA TGC
AGAAAATTAG CACCGCTCCG GACTATTCGT ACG
```

Figure 7B: sequence of the synthetic CH1 gene segment

```
     A  S   T  K  G   P  S  V  F   P  L  A   P  S  S
 BlpI   SalI
~~~~~~~~~~~~~~~~
GCTCAGCGTC GACCAAAGGT CCAAGCGTGT TTCCGCTGGC TCCGAGCAGC
CGAGTCGCAG CTGGTTTCCA GGTTCGCACA AAGGCGACCG AGGCTCGTCG

 K  S  T  S   G  G  T   A  A  L   G  C  L  V   K  D  Y
AAAAGCACCA GCGGCGGCAC GGCTGCCCTG GGCTGCCTGG TTAAAGATTA
TTTTCGTGGT CGCCGCCGTG CCGACGGGAC CCGACGGACC AATTTCTAAT

  F  P  E   P  V  T  V   S  W  N   S  G  A   L  T  S
TTTCCCGGAA CCAGTCACCG TGAGCTGGAA CAGCGGGGCG CTGACCAGCG
AAAGGGCCTT GGTCAGTGGC ACTCGACCTT GTCGCCCCGC GACTGGTCGC

G  V  H  T   F  P  A   V  L  Q  S   S  G  L   Y  S  L
GCGTGCATAC CTTTCCGGCG GTGCTGCAAA GCAGCGGCCT GTATAGCCTG
CGCACGTATG GAAAGGCCGC CACGACGTTT CGTCGCCGGA CATATCGGAC

 S  S  V  V   T  V  P   S  S  S   L  G  T  Q   T  Y  I
AGCAGCGTTG TGACCGTGCC GAGCAGCAGC TTAGGCACTC AGACCTATAT
TCGTCGCAAC ACTGGCACGG CTCGTCGTCG AATCCGTGAG TCTGGATATA
```

Figure 7B: sequence of the synthetic CH1 gene segment (continued)

```
  C  N  V   N  H  K  P   S  N  T   K  V  D   K  K  V
TTGCAACGTG AACCATAAAC CGAGCAACAC CAAAGTGGAT AAAAAAGTGG
AACGTTGCAC TTGGTATTTG GCTCGTTGTG GTTTCACCTA TTTTTTCACC

E  P  K  S   E  F  *
             EcoRI    HindIII
            ~~~~~~~   ~~~~~~
AACCGAAAAG CGAATTCTGA TAAGCTT
TTGGCTTTTC GCTTAAGACT ATTCGAA
```

Figure 7C: functional map and sequence of module 24 comprising the synthetic Cλ gene segment (huCL lambda)

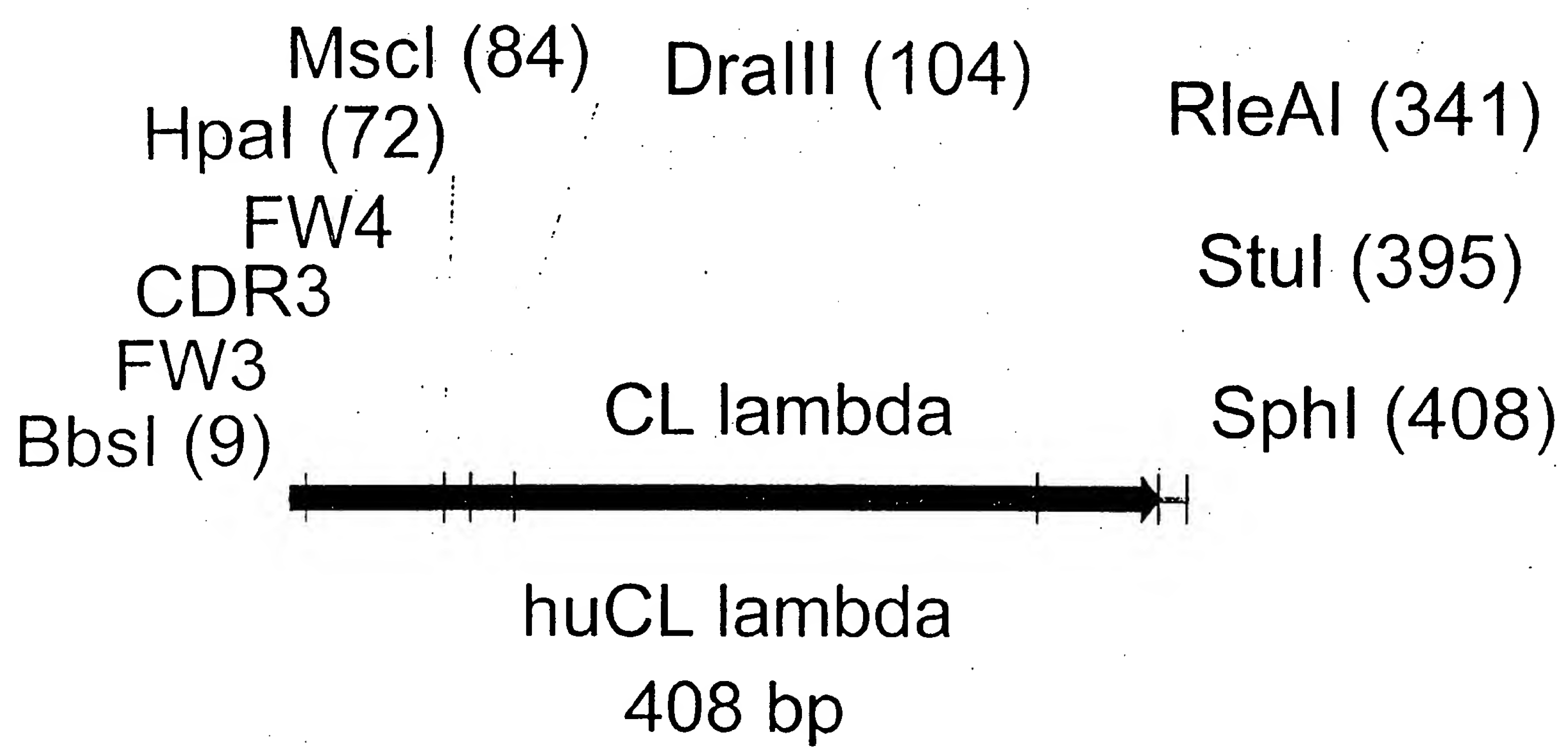


Figure 7C: functional map and sequence of module 24 comprising the synthetic Cl gene segment (huCL lambda) (continued)

```
      BbsI
     ~~~~~~~
  1  GAAGACGAAG CGGATTATTA TTGCCAGCAG CATTATACCA CCCCGCCTGT
     CTTCTGCTTC GCCTAATAAT AACGGTCGTC GTAATATGGT GGGGCGGACA

                          HpaI           MscI         DraIII
                         ~~~~~~~~       ~~~~~~~          ~~~
 51  GTTTGGCGGC GGCACGAAGT TAACCGTTCT TGGCCAGCCG AAAGCCGCAC
     CAAACCGCCG CCGTGCTTCA ATTGGCAAGA ACCGGTCGGC TTTCGGCGTG

     DraIII
     ~~~~~~~
101  CGAGTGTGAC GCTGTTTCCG CCGAGCAGCG AAGAATTGCA GGCGAACAAA
     GCTCACACTG CGACAAAGGC GGCTCGTCGC TTCTTAACGT CCGCTTGTTT

151  GCGACCCTGG TGTGCCTGAT TAGCGACTTT TATCCGGGAG CCGTGACAGT
     CGCTGGGACC ACACGGACTA ATCGCTGAAA ATAGGCCCTC GGCACTGTCA

201  GGCCTGGAAG GCAGATAGCA GCCCCGTCAA GGCGGGAGTG GAGACCACCA
     CCGGACCTTC CGTCTATCGT CGGGGCAGTT CCGCCCTCAC CTCTGGTGGT
```

Figure 7C: functional map and sequence of module 24 comprising the synthetic CI gene segment (huCL lambda) (continued)

```
251   CACCCTCCAA ACAAAGCAAC AACAAGTACG CGGCCAGCAG CTATCTGAGC
      GTGGGAGGTT TGTTTCGTTG TTGTTCATGC GCCGGTCGTC GATAGACTCG

                             RleAI
                            ~~~~~~~
301   CTGACGCCTG AGCAGTGGAA GTCCCACAGA AGCTACAGCT GCCAGGTCAC
      GACTGCGGAC TCGTCACCTT CAGGGTGTCT TCGATGTCGA CGGTCCAGTG

                                                  StuI
                                                ~~~~~~~
351   GCATGAGGGG AGCACCGTGG AAAAAACCGT TGCGCCGACT GAGGCCTGAT
      CGTACTCCCC TCGTGGCACC TTTTTTGGCA ACGCGGCTGA CTCCGGACTA

         SphI
        ~~~~~~
401   AAGCATGC
      TTCGTACG
```

Figure 7D: oligonucleotides used for synthesis of module M24 containing Cλ gene segment

M24: assembly PCR

M24-A: GAAGACAAGCGGATTATTATTGCCAGCAGCATTATACCACCCCGCCTGTGTTTGGCGGCG-
GCACGAAGTTAACCGTTC

M24-B: CAATTCTTCGCTGCTCGGCGGAAACAGCGTCACACTCGGTGCGGCTTTCGGCTGGCCAA-
GAACGGTTAACTTCGTGCCGC

M24-C: CGCCGAGCAGCGAAGAATTGCAGGCGAACAAAGCGACCCTGGTGTGCCTGATTAGCGACT-
TTTATCCGGGAGCCGTGACA

M24-D: TGTTTGGAGGGTGTGGTGGTCTCCACTCCCGCCTTGACGGGGCTGCTATCTGCCTTCCAG-
GCCACTGTCACGGCTCCCGG

M24-E: CCACACCCTCCAAACAAAGCAACAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGACGC-
CTGAGCAGTGGAAGTCCCACAGAAGCTACAGCTG

M24-F: GCATGCTTATCAGGCCTCAGTCGGCGCAACGGTTTTTTCCACGGTGCTCCCCTCATGCGT-
GACCTGGCAGCTGTAGCTTC

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2

```
 M  K  Q  S   T  I  A   L  A  L   L  P  L  L   F  T  P
                                          SapI
                                      ~~~~~~~~~
ATGAAACAAA GCACTATTGC ACTGGCACTC TTACCGTTGC TCTTCACCCC
TACTTTGTTT CGTGATAACG TGACCGTGAG AATGGCAACG AGAAGTGGGG

 V  T  K   A  D  Y  K   D  E  V   Q  L  V   E  S  G
                                  MfeI
                                 ~~~~~~
TGTTACCAAA GCCGACTACA AAGATGAAGT GCAATTGGTG GAAAGCGGCG
ACAATGGTTT CGGCTGATGT TTCTACTTCA CGTTAACCAC CTTTCGCCGC

G  G  L  V   Q  P  G   G  S  L  R   L  S  C   A  A  S
                                                 BspEI
                                                   ~~~
GCGGCCTGGT GCAACCGGGC GGCAGCCTGC GTCTGAGCTG CGCGGCCTCC
CGCCGGACCA CGTTGGCCCG CCGTCGGACG CAGACTCGAC GCGCCGGAGG

 G  F  T  F   S  S  Y   A  M  S   W  V  R  Q   A  P  G
BspEI                                          BstXI
~~~                                       ~~~~~~~~~~~~~
GGATTTACCT TTAGCAGCTA TGCGATGAGC TGGGTGCGCC AAGCCCCTGG

CCTAAATGGA AATCGTCGAT ACGCTACTCG ACCCACGCGG TTCGGGGACC
```

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2 (continued)

```
  K  G  L  E  W  V  S  A  I  S  G  S  G  G  S  T
        XhoI
       ~~~~~~~~
GAAGGGTCTC GAGTGGGTGA GCGCGATTAG CGGTAGCGGC GGCAGCACCT
CTTCCCAGAG CTCACCCACT CGCGCTAATC GCCATCGCCG CCGTCGTGGA

Y  Y  A  D  S  V  K  G  R  F  T  I  S  R  D  N  S
                                       PmlI       NspV
                                     ~~~~~~~~     ~~~~
ATTATGCGGA TAGCGTGAAA GGCCGTTTTA CCATTTCACG TGATAATTCG
TAATACGCCT ATCGCACTTT CCGGCAAAAT GGTAAAGTGC ACTATTAAGC

 K  N  T  L  Y  L  Q  M  N  S  L  R  A  E  D  T  A
NspV                                              EagI
~~                                                ~~~~
AAAAACACCC TGTATCTGCA AATGAACAGC CTGCGTGCGG AAGATACGGC
TTTTTGTGGG ACATAGACGT TTACTTGTCG GACGCACGCC TTCTATGCCG

  V  Y  Y  C  A  R  W  G  G  D  G  F  Y  A  M  D
EagI        BssHII
~~          ~~~~~~~
CGTGTATTAT TGCGCGCGTT GGGGCGGCGA TGGCTTTTAT GCGATGGATT
```

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2 (continued)

```
GCACATAATA ACGCGCGCAA CCCCGCCGCT ACCGAAAATA CGCTACCTAA
Y  W  G  Q    G  T  L   V  T  V  S   S  A  G   G  G  S
         StyI                          BlpI
        ~~~~~~~~                      ~~~~~~~~
ATTGGGGCCA AGGCACCCTG GTGACGGTTA GCTCAGCGGG TGGCGGTTCT
TAACCCCGGT TCCGTGGGAC CACTGCCAAT CGAGTCGCCC ACCGCCAAGA

 G  G  G  G   S  G  G   G  G  S   G  G  G  G   S  D  I
                                                 EcoRV
                                                 ~~~~~
GGCGGCGGTG GGAGCGGTGG CGGTGGTTCT GGCGGTGGTG GTTCCGATAT
CCGCCGCCAC CCTCGCCACC GCCACCAAGA CCGCCACCAC CAAGGCTATA

  V  M  T   Q  S  P  L   S  L  P   V  T  P   G  E  P
EcoRV            BanII
~               ~~~~~~~
CGTGATGACC CAGAGCCCAC TGAGCCTGCC AGTGACTCCG GGCGAGCCTG
GCACTACTGG GTCTCGGGTG ACTCGGACGG TCACTGAGGC CCGCTCGGAC

A  S  I  S   C  R  S   S  Q  S  L   L  H  S   N  G  Y
            PstI
           ~~~~~~
CGAGCATTAG CTGCAGAAGC AGCCAAAGCC TGCTGCATAG CAACGGCTAT
GCTCGTAATC GACGTCTTCG TCGGTTTCGG ACGACGTATC GTTGCCGATA
```

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2 (continued)

```
 N  Y  L  D   W  Y  L   Q  K  P   G  Q  S  P   Q  L  L
              KpnI           SexAI                AseI
             -------       ---------              ---
AACTATCTGG ATTGGTACCT TCAAAAACCA GGTCAAAGCC CGCAGCTATT
TTGATAGACC TAACCATGGA AGTTTTTGGT CCAGTTTCGG GCGTCGATAA

  I  Y  L   G  S  N  R   A  S  G   V  P  D   R  F  S
AseI                             EcoO109I
---                               ---------
AATTTATCTG GGCAGCAACC GTGCCAGTGG GGTCCCGGAT CGTTTTAGCG
TTAAATAGAC CCGTCGTTGG CACGGTCACC CCAGGGCCTA GCAAAATCGC

G  S  G  S   G  T  D   F  T  L  K   I  S  R   V  E  A
     BamHI
    --------
GCTCTGGATC CGGCACCGAT TTTACCCTGA AAATTAGCCG TGTGGAAGCT
CGAGACCTAG GCCGTGGCTA AAATGGGACT TTTAATCGGC ACACCTTCGA

 E  D  V  G   V  Y  Y   C  Q  Q   H  Y  T  T   P  P  T
 BbsI
-------
GAAGACGTGG GCGTGTATTA TTGCCAGCAG CATTATACCA CCCCGCCGAC
CTTCTGCACC CGCACATAAT AACGGTCGTC GTAATATGGT GGGGCGGCTG
```

Figure 8: sequence and restriction map of the synthetic gene encoding the consensus single-chain fragment VH3-Vκ2 (continued)

```
  F  G  Q   G  T  K  V   E  I  K   R  T  E   F
   MscI                            BsiWI EcoRI
   ~~~~~~                          ~~~~~~~~~~~~~
CTTTGGCCAG GGTACGAAAG TTGAAATTAA ACGTACGGAA TTC
GAAACCGGTC CCATGCTTTC AACTTTAATT TGCATGCCTT AAG
```

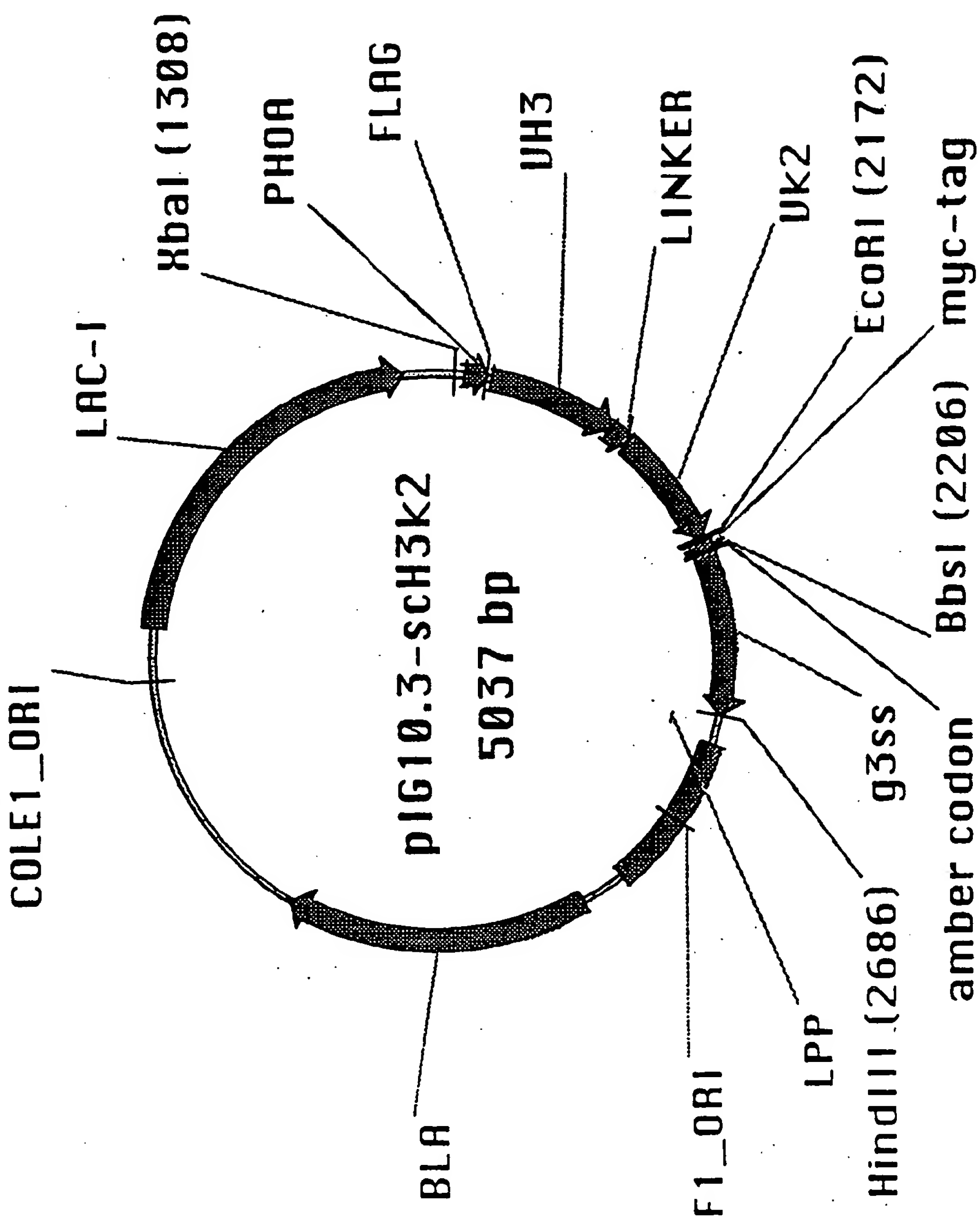


Figure 9: Phage display vector pIG10.3

Figure 10: Sequence analysis of initial libraries

	92	93	94	95	96	97	98	99	100	100A	100B	100C	100D	100E	101	102	103
A	C	A	R	W	G	G	D	G	F	Y	A	-	-	M	D	Y	W
B	C	A	R	F	G	K	M	N	Y	-	-	-	-	-	D	Y	W
	C	A	R	H	R	T	E	W	H	-	-	-	-	-	D	Y	W
	C	A	R	V	R	E	L	Y	H	-	-	-	-	-	D	Y	W
	C	A	R	K	F	L	K	A	R	-	-	-	-	-	D	Y	W
	C	A	R	W	N	T	T	G	Y	-	-	-	-	-	D	Y	W
	C	A	R	I	N	E	A	Q	P	-	-	-	-	-	D	Y	W
	C	A	R	T	A	I	T	R	-	-	-	-	-	-	D	Y	W
	C	A	R	W	Y	N	R	N	S	-	-	-	-	-	D	Y	W
	C	A	R	S	V	G	D	S	K	-	-	-	-	-	D	Y	W
	C	A	R	S	K	T	F	A	A	-	-	-	-	-	D	Y	W
	C	A	R	V	A	P	Q	Y	D	-	-	-	-	-	D	Y	W
	C	A	R	M	Q	S	E	W	M	-	-	-	-	-	D	Y	W

Figure 10: Sequence analysis of initial libraries

C	C	A	R	Y	F	V	H	F	L	Y	T	M	V	M	D	V	W
	C	A	R	M	A	L	R	A	S	G	K	Y	I	M	D	V	W
	C	A	R	K	N	Q	M	V	F	H	A	R	K	F	D	V	W
	C	A	R	T	Q	S	F	W	E	Q	Q	K	V	M	D	Y	W
	C	A	R	Y	P	Y	R	S	N	F	F	M	P	M	D	V	W
	C	A	R	*	G	S	G	S	E	H	W	S	I	F	D	V	W
	C	A	R	R	N	P	W	N	V	N	Y	L	H	F	D	V	W
	C	A	R	M	K	P	M	L	N	R	D	G	T	M	D	V	W
	C	A	R	K	G	S	E	F	L	E	T	D	V	M	D	Y	W
	C	A	R	S	W	T	N	D	K	P	N	F	I	M	D	V	W
	C	A	R	Y	A	G	T	T	F	K	Q	G	P	M	D	Y	W

Figure 11: Expression analysis of initial library

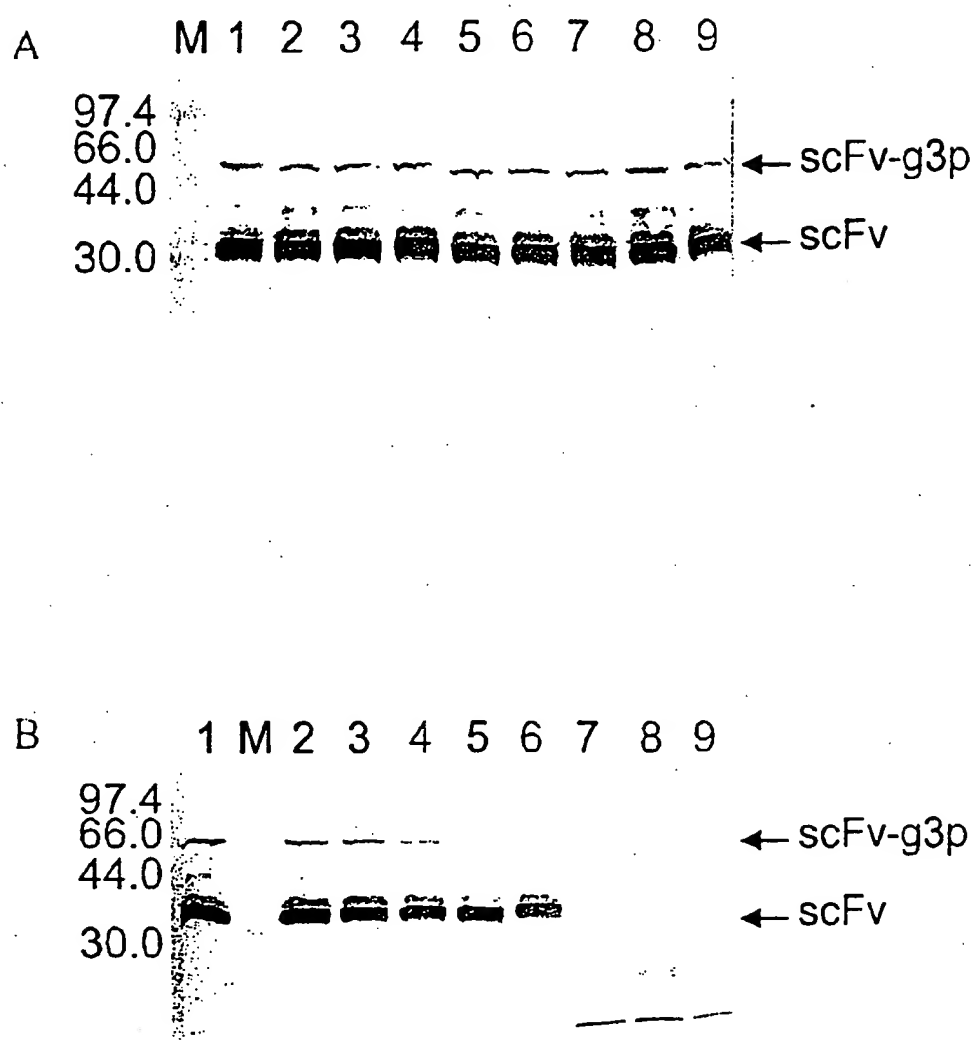


Figure 12: Increase of specificity during the panning rounds

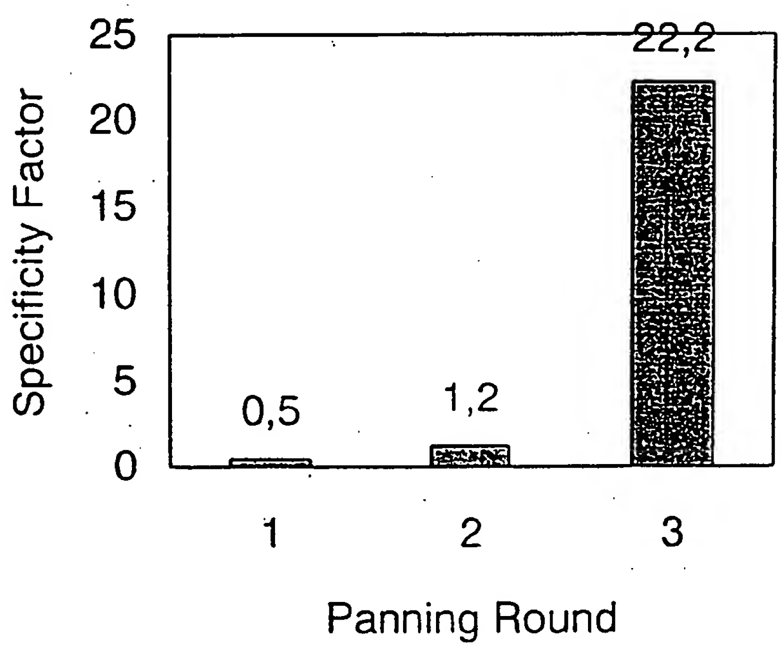


Figure 13: Phage ELISA of clones after the 3rd round of panning

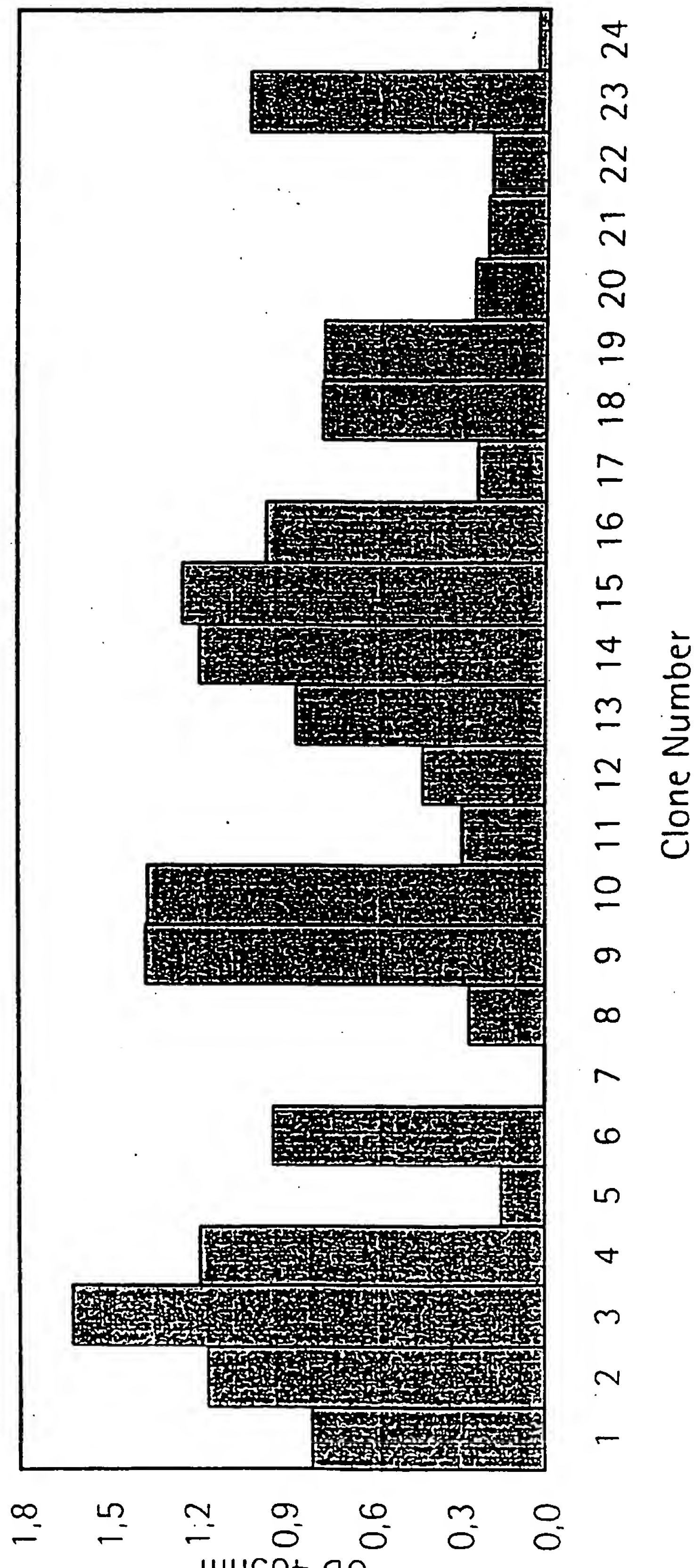


Figure 14: Competition ELISA

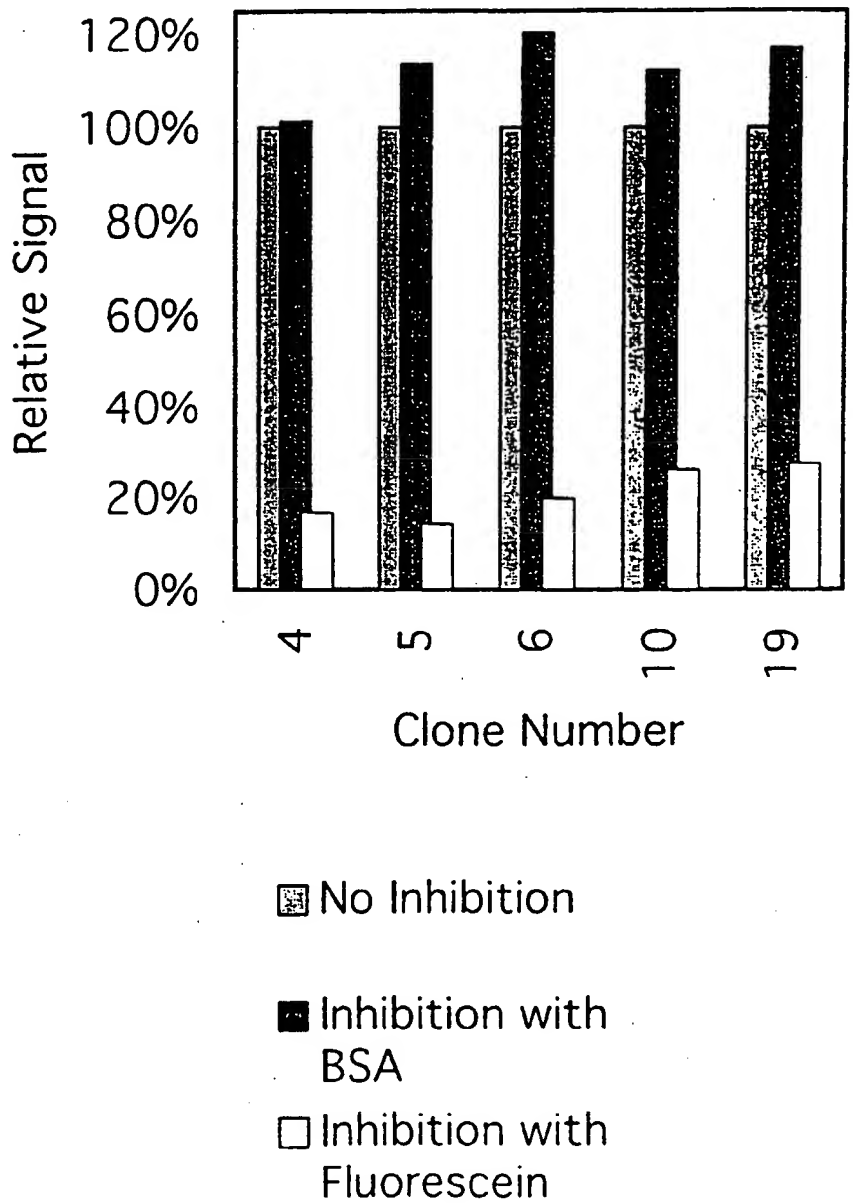


Figure 15: Sequence analysis of fluorescein binders

92	93	94	95	96	97	98	99	100	100A	100B	100C	100D	100E	101	102	103	Frequency
C	A	R	K	R	M	M	Q	N	P	R	F	R	F	D	V	W	1
C	A	R	R	S	K	Q	K	R	K	M	R	R	F	D	V	W	3
C	A	R	R	N	G	K	R	H	L	R	H	R	F	D	V	W	1
C	A	R	R	K	M	R	K	R	I	K	R	R	F	D	V	W	2
C	A	R	Y	R	K	I	M	K	W	K	N	S	F	D	V	W	1
C	A	R	L	I	E	V	H	P	S	F	D	Q	M	D	V	W	1
C	A	R	R	K	P	M	F	L	K	K	A	V	F	D	V	W	1
C	A	R	R	K	F	H	R	Y	S	T	V	K	F	D	Y	W	2
C	A	R	R	K	T	M	R	S	R	V	K	Y	F	D	Y	W	1
C	A	R	K	K	R	S	W	R	R	M	D	R	F	D	V	W	1
C	A	R	R	N	P	R	R	G	R	M	N	R	F	D	V	W	1
C	A	R	K	G	K	K	K	F	A	R	P	R	F	D	V	W	1
C	A	R	R	M	V	H	K	G	K	R	K	I	F	D	V	W	1
C	A	R	R	K	H	I	T	Y	P	R	K	Q	F	D	V	W	1
C	A	R	R	W	T	K	R	R	S	F	A	R	F	D	V	W	1
C	A	R	K	K	L	K	Q	Y	T	F	S	R	F	D	Y	W	1

Figure 16: Purification of fluorescein binding scFv fragments

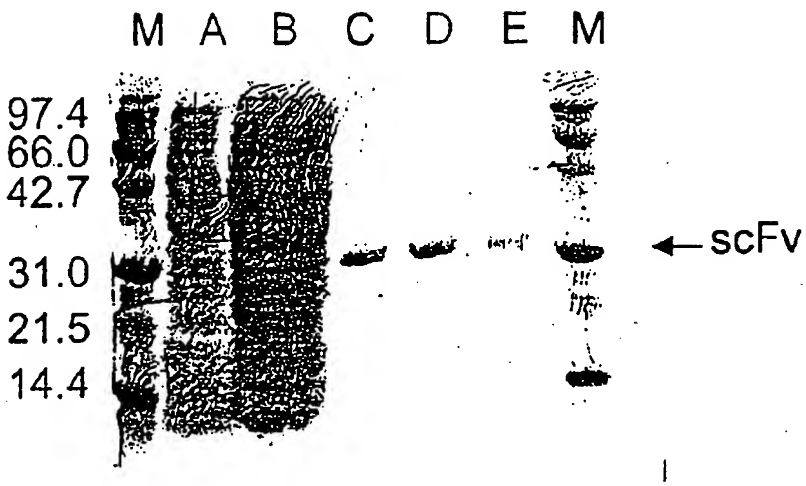
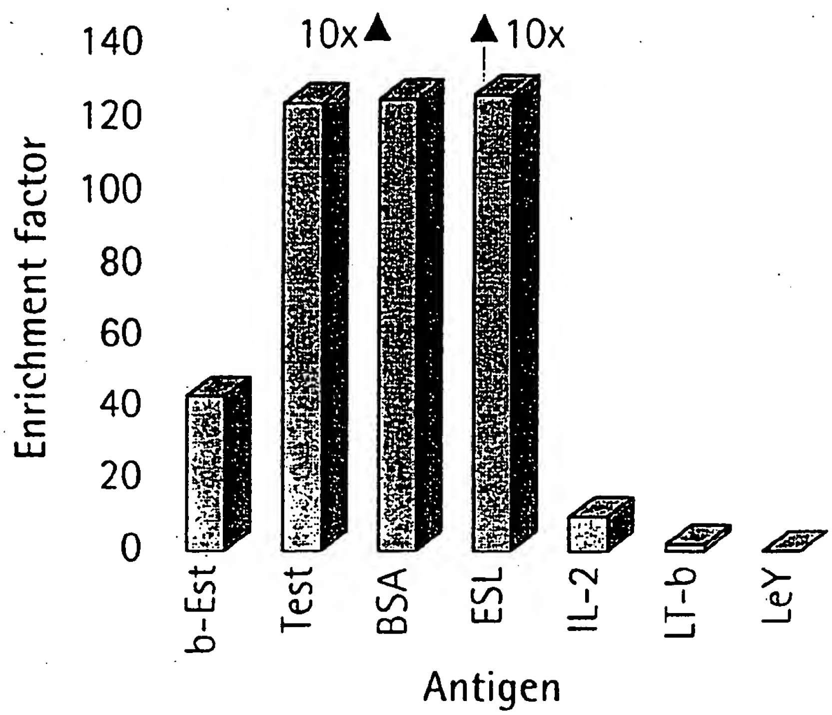


Figure 17: Enrichment factors after three rounds of panning



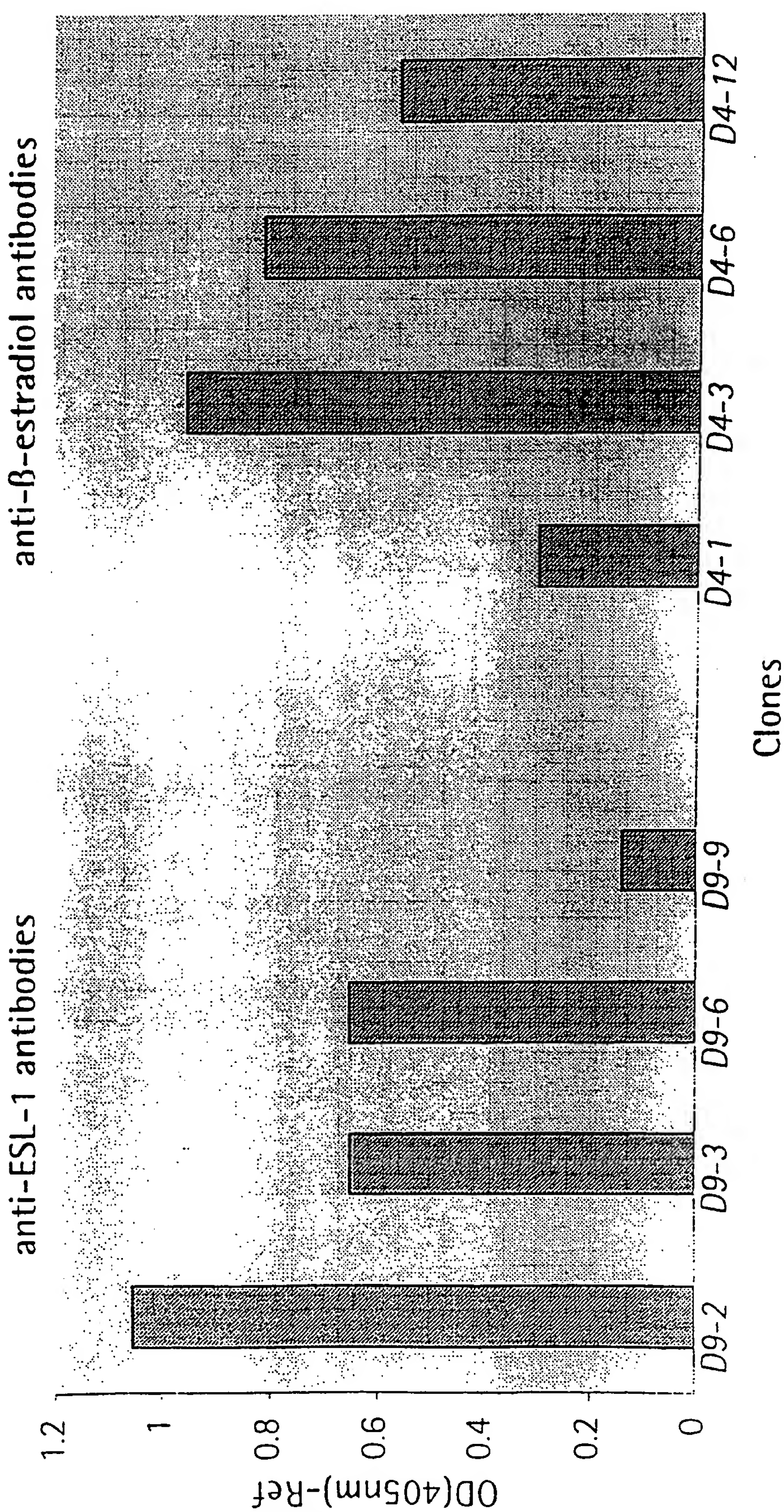


Figure 18: ELISA of anti-ESL-1 and anti-β-estradiol antibodies

Figure 19: Selectivity and cross-reactivity of HuCAL antibodies

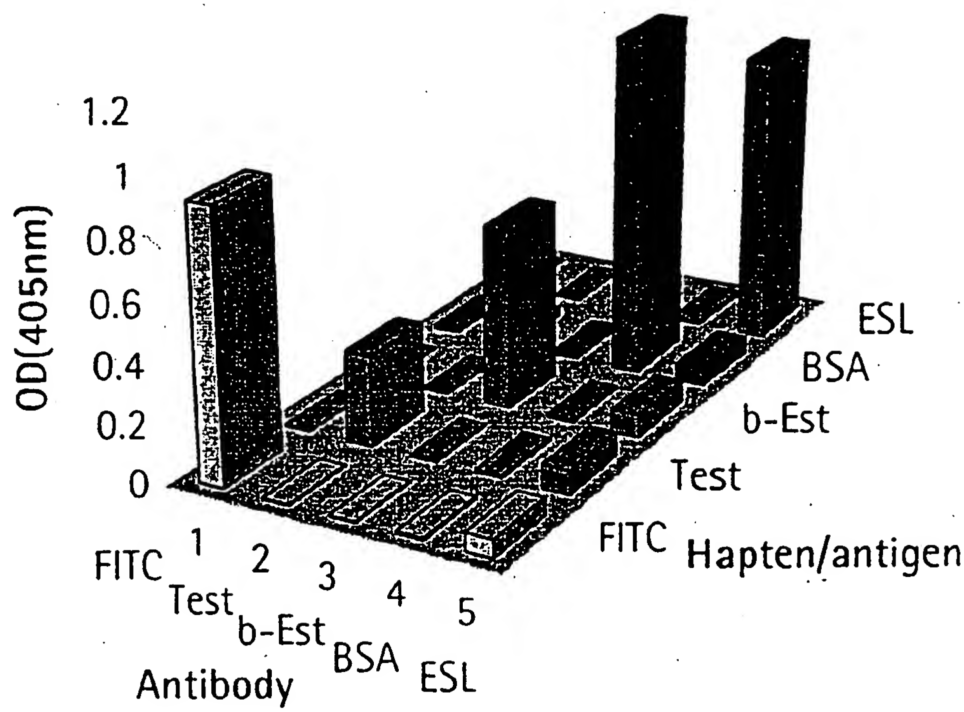


Figure 20: Sequence analysis of estradiol binders

92	93	94	95	96	97	98	99	100	100A	100B	100C	100D	100E	101	102	103	Frequency
C	A	R	T	R	P	W	Q	A	T	R	K	G	F	D	V	W	3
C	A	R	N	Q	W	E	F	K	N	R	R	K	M	D	Y	W	8
C	A	R	K	R	W	M	W	P	I	G	K	R	F	D	Y	W	7
C	A	R	Y	S	L	W	R	L	D	E	Y	F	F	D	Y	W	1
C	A	R	V	P	W	G	D	F	W	S	W	H	M	D	V	W	1
C	A	R	N	G	L	E	P	R	H	R	K	M	M	D	Y	W	1
C	A	R	I	M	K	A	P	P	-	-	-	-	-	D	Y	W	1
C	A	R	R	K	T	W	H	W	F	Y	K	R	M	D	Y	W	1
C	A	R	W	K	D	M	W	S	Q	V	Y	V	M	D	Y	W	1
C	A	R	N	K	Q	Q	M	R	F	R	R	F	M	D	Y	W	5
C	A	R	N	M	L	A	L	S	R	G	K	E	M	D	V	W	4
C	A	R	N	M	R	L	M	R	M	R	K	N	F	D	V	W	1

Figure 21: Sequence analysis of testosterone binders

92	93	94	95	96	97	98	99	100	100A	100B	100C	100D	100E	101	102	103	Frequency
C	A	R	Y	I	K	Q	A	K	R	K	L	A	F	D	Y	W	4
C	A	R	Y	N	R	H	A	W	Q	K	M	Q	F	D	Y	W	3
C	A	R	Y	V	K	Y	A	R	N	K	M	Q	F	D	Y	W	2
C	A	R	Y	K	R	G	A	W	M	K	T	M	F	D	V	W	1
C	A	R	R	K	P	L	R	R	I	M	K	W	F	D	Y	W	1
C	A	R	Y	R	K	R	A	S	R	Q	M	Q	F	D	Y	W	1

Figure 22: Sequence analysis of lymphotoxin-ß binders

92	93	94	95	96	97	98	99	100	100A	100B	100C	100D	100E	101	102	103	Frequency
C	A	R	Q	R	Y	R	S	K	I	K	G	H	F	D	V	W	16
C	A	R	_	W	R	D	F	N	S	Y	D	P	M	D	Y	W	1
C	A	R	M	A	D	L	D	N	Y	W	V	Q	F	D	Y	W	1
C	A	R	L	Q	A	Y	L	K	P	H	H	W	M	D	Y	W	1
C	A	R	R	L	I	E	Q	A	R	D	H	V	M	D	Y	W	1
C	A	R	S	W	H	N	S	Q	F	T	Q	S	F	D	V	W	1
C	A	R	V	D	H	F	Q	T	E	N	E	W	M	D	Y	W	1
C	A	R	D	W	P	T	L	I	F	W	Y	W	F	D	Y	W	1

Figure 23: Sequence analysis of ESL-1 binders

92	93	94	95	96	97	98	99	100	100A	100B	100C	100Ca	100D	100E	101	102	103	Frequency
C	A	R	G	F	G	F	T	E	-	-	-	-	-	-	D	Y	W	4
C	A	R	Q	F	D	E	D	S	F	V	R	-	R	F	D	V	W	4
C	A	R	I	L	K	E	S	S	K	S	R	-	Q	M	D	V	W	2
C	A	R	E	Q	D	E	Y	G	A	I	R	-	I	M	D	Y	W	1
C	A	R	N	H	F	E	A	S	W	P	R	R	Q	M	D	V	W	1
C	A	R	E	N	E	W	V	D	M	I	L	-	D	M	D	Y	W	2
C	A	R	Q	Y	S	E	T	R	W	V	R	-	K	F	D	Y	W	1
C	A	R	Q	F	K	E	S	K	T	R	R	-	K	F	D	V	W	13
C	A	R	K	K	T	Q	Y	V	H	D	W	-	R	M	D	V	W	3
C	A	R	R	W	R	E	T	K	S	K	R	-	F	F	D	V	W	1
C	A	R	D	Y	I	M	E	F	-	-	-	-	-	-	D	Y	W	1
C	A	R	Q	F	E	E	T	K	Q	R	R	-	L	M	D	Y	W	1

Figure 24: Sequence analysis of BSA binders

92	93	94	95	96	97	98	99	100	100A	100B	100C	100D	100E	101	102	103	Frequency
C	A	R	D	Q	G	F	Y	A	I	D	Y	V	M	D	Y	W	5
C	A	R	V	F	T	Y	M	Y	N	Y	F	R	F	D	V	W	1
C	A	R	V	F	F	E	Q	M	E	V	V	R	M	D	V	W	1
C	A	R	E	K	E	Y	R	L	S	W	S	Q	M	D	Y	W	1
C	A	R	Y	P	S	R	W	A	P	N	W	Y	M	D	Y	W	1
C	A	R	D	G	G	F	K	P	L	T	H	F	F	D	V	W	1

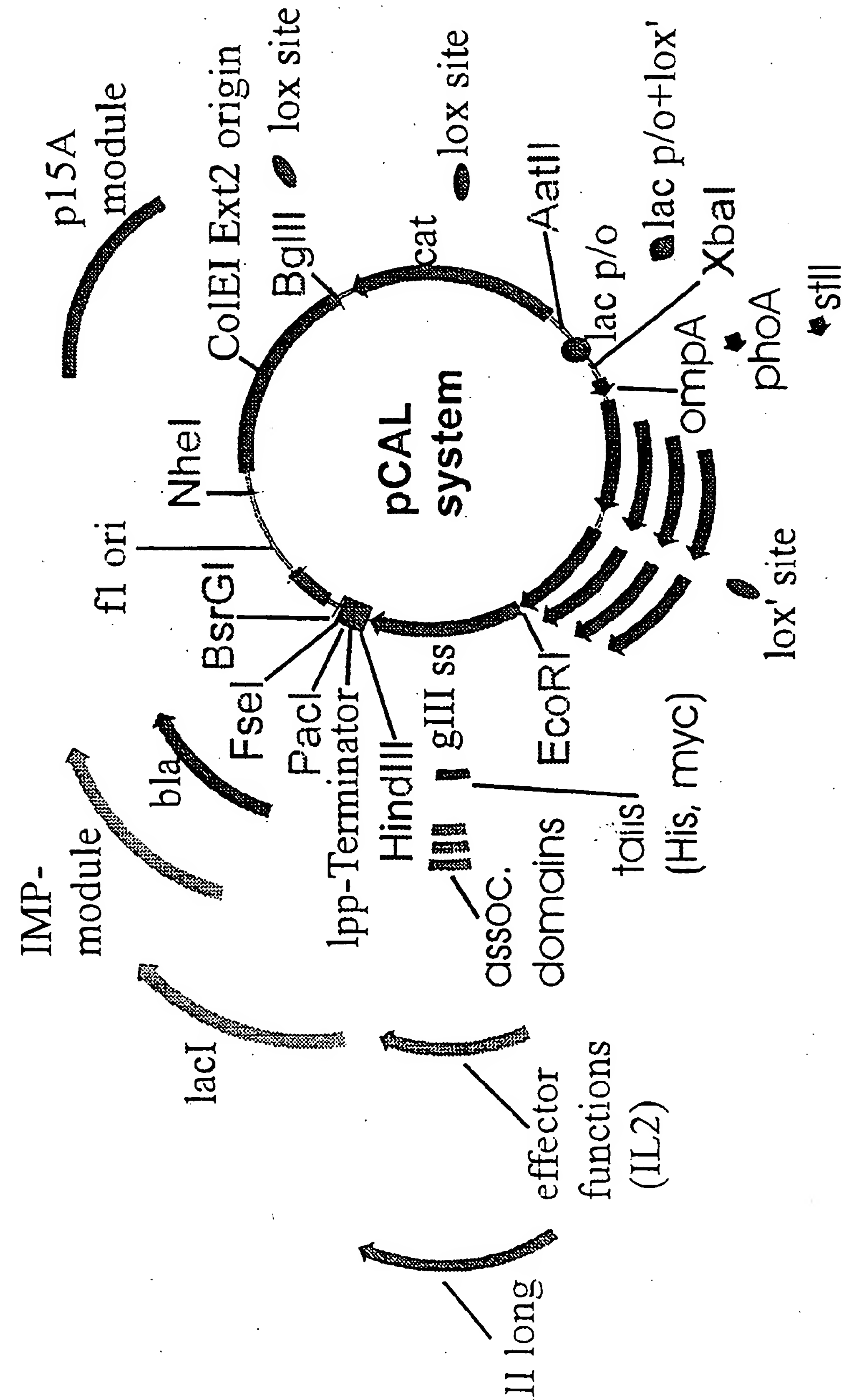


Figure 25: modular pCAL vector system

Figure 25a: List of unique restriction sites used in or suitable for HuCAL genes or pCAL vectors

unique restriction site	Isoschizomers
AatII	/
AflII	BfrI, BspTI, Bst98I
AscI	/
AseI	VspI, AsnI, PshBI
BamHI	BstI
BbeI	EheI, KasI, NarI
BbsI	BpuAI, BpiI
BglII	/
BlpI	Bpu1102I,CelII, BlpI
BsaBI	MamI, Bsh1365I, BsrBRI
BsiWI	Pfl23II, SplI, SunI
BspEI	AccIII, BseAI, BsiMI, Kpn2I, MroI
BsrGI	Bsp1407I, SspBI
BssHII	PauI
BstEII	BstPI, Eco91I, EcoO651
BstXI	/
Bsu36I	AocI, CvnI, Eco81I
DraIII	/
DsmAI	
EagI	BstZI, EclXI, Eco52I, XmaIII
Eco57I	/
EcoO109I	DraII
EcoRI	/
EcoRV	Eco32I
FseI	/
HindIII	/
HpaI	/
KpnI	Acc65I, Asp718I
MluI	/
MscI	BalI, MluNI

Figure 25a: List of unique restriction sites used in or suitable for HuCAL genes or pCAL vectors

unique restriction site	Isoschizomers
MunI	MfeI
NheI	/
NsiI	Ppu10I, EcoT22I, Mph1103I
NspV	Bsp119I, BstBI, Csp45I, LspI, SfuI
PacI	/
PmeI	/
PmlI	BbrPI, Eco72I, PmaCI
Psp5II	PpuMI
PstI	/
RsrII	(RsriI), CpoI, CspI
SanDI	/
SapI	/
SexAI	/
SpeI	/
SfiI	/
SphI	BbuI, PaeI,NspI
StuI	AatI, Eco147I
StyI	Eco130I, EcoT14I
XbaI	BspLU11I
XhoI	PaeR7I
XmaI	AvaI, SmaI, Cfr9I, PspAI

Figure26: list of pCAL vector modules

No	module/flanking restriction sites	functional element	sites to be removed	sites to be inserted	template	reference
M1	AatII-lacp/o-XbaI	lac promotor/operator	2x VspI (AseI)	AatII	vector pASK30	Skerra et al. (1991) Bio/Technology 9, 273-278
M2	BglII-lox-AatII	Cre/lox recombination site	2x VspI (AseI)	lox, BglII	(synthetic)	Hoess et al. (1986) Nucleic Acids Res. 2287-2300
M3	XbaI-lox'-SphI	Cre/lox' recombination site	none	lox', SphI	(synthetic)	see M2
M7-I	EcoRI-gIIIlong-HindIII	gIIIp of filamentous phage with N-terminal myctail/amber codon	SphI, BamHI	none	vector pIG10	Ge et al., (1994) Expressing antibodies in E. coli. In: Antibody engineering: A practical approach. IRL Press, New York, pp 229-266

Figure26: list of pCAL vector modules

M7-II	EcoRI-gIIIss-HindIII	truncated gIIIp of filamentous phage with N-terminal Gly-Ser linker	SphI		vector pIG10	see M7-I
M7-III	EcoRI-gIIIss-HindIII	truncated gIIIp of filamentous phage with N-terminal myctail/amber codon	SphI, BbsI		vector pIG10	see M7-I
M8	SphI-lox-HindIII	Cre/lox recombination site	none	lox	(synthetic)	see M3
M9-II	HindIII-lpp-PacI	lpp-terminator	none	PacI, FseI	(synthetic)	see M1
M10-II	PacI/FseI-bla-BsrGI	beta-lactamase/bla (ampR)	VspI, Eco57I, BssSI	PacI, FseI, BsrGI	pASK30	see M1
M11-II	BsrGI-f1 ori-NheI	origin of single-stranded replication	DraIII (BanII not removed)	BsrGI, NheI	pASK30	see M1
M11-III	BsrGI-f1 ori-NheI	origin of single-stranded replication	DraIII, BanII	BsrGI, NheI	pASK30	see M1

Figure26: list of pCAL vector modules

M12	NheI-p15A-BglII	origin of double-stranded replication	BssSI, VspI, NspV	NheI, BglII	pACYC184	Rose, R.E. (1988) Nucleic Acids Res. 16, 355
M13	BglII-lox-BglII	Cre/lox recombination site	none	BglII, lox, XmnI	(synthetic)	see M3
M14-Ext2	BglII-ColEI-NheI	origin of double-stranded replication	Eco57I (BssSI not removed)	BglII, NheI	pUC19	Yanisch-Peron, C. (1985) Gene 33,103-119
M17	AatII-cat-BglII	chloramphenicol-acetyltransferase/ cat (camR)	BspEI, MscI, StyI/NcoI		pACYC184	Cardoso, M. & Schwarz,S. (1992) J. Appl. Bacteriol.72, 289-293
M19	XbaI-phoA-EcoRI	signal sequence of phosphatase A	(synthetic)		(synthetic)	see M1
M20	XbaI-phoA-FLAG-EcoRI	signal sequence of phosphatase A + FLAG detection tag	(synthetic)		(synthetic)	Knappik, A & Plückthun, A. (1994) BioTechniques 17, 754-761

Figure26: list of pCAL vector modules

M21	XbaI-stII-SapI	heat-stable enterotoxin II signal sequence	(synthetic)		(synthetic)	Lee et al. (1983) Infect. Immunol. 264-268
M41	AflII-lacI-NheI	lac-repressor	BstXI, MluI,BbsI, BanII, BstEII, HpaI, BbeI, VspI		pASK30	see M1
M42	EcoRI-Histail-HindIII	poly-histidine tail	(synthetic)		(synthetic)	Lindner et al., (1992) Methods: a companion to methods in enzymology 4, 41-56

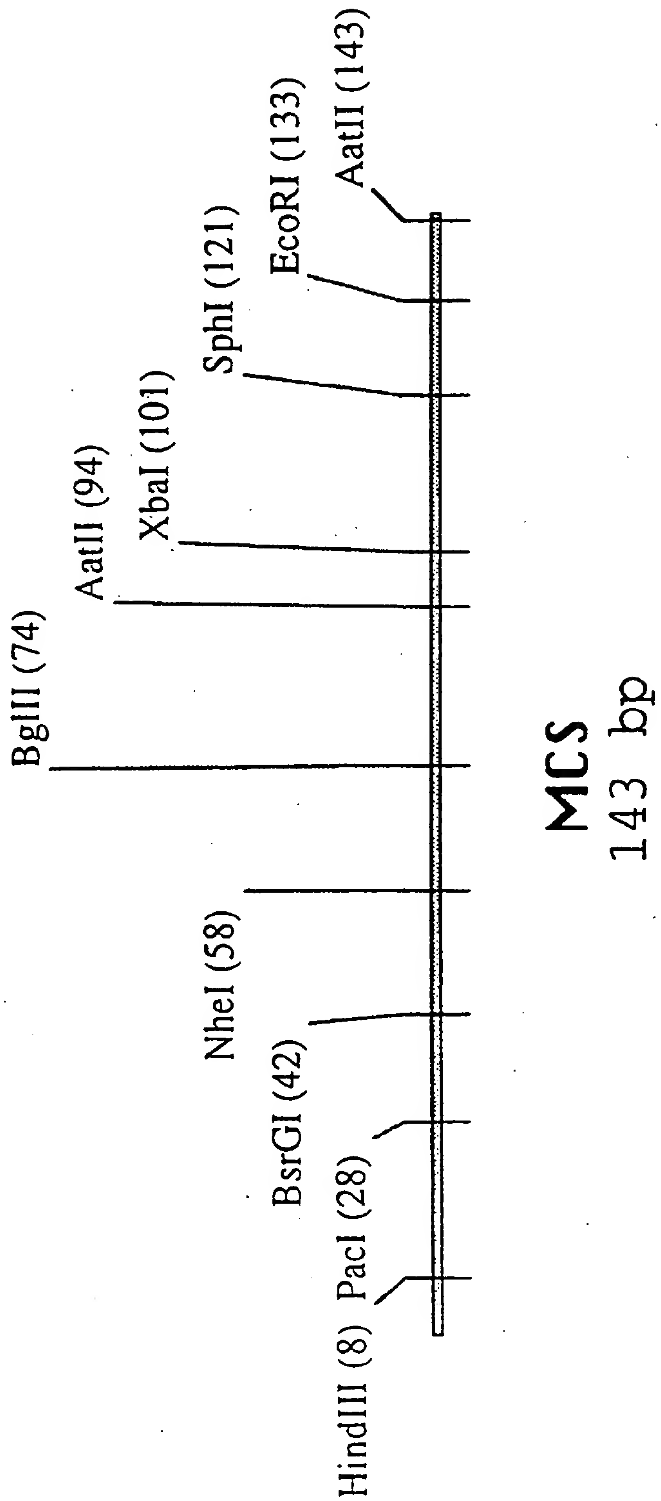


Figure 27: functional map and sequence of MCS module

Figure 27: functional map and sequence of MCS module (continued)

```
             HindIII              PacI                BsrGI
             ~~~~~~~~           ~~~~~~~~~            ~~~~~~~
  1   ACATGTAAGC TTCCCCCCCC CCTTAATTAA CCCCCCCCCC TGTACACCCC
      TGTACATTCG AAGGGGGGGG GGAATTAATT GGGGGGGGGG ACATGTGGGG

              NheI               BglII             AatII   XbaI
             ~~~~~~~~           ~~~~~~~          ~~~~~~~~     ~
 51   CCCCCCGCTA GCCCCCCCCC CCAGATCTCC CCCCCCCCGA CGTCCCCCCT
      GGGGGGCGAT CGGGGGGGGG GGTCTAGAGG GGGGGGGGCT GCAGGGGGGA

      XbaI              SphI                EcoRI AatII
      ~~~~~            ~~~~~~~~           ~~~~~~~~~~~~~
101   CTAGACCCCC CCCCCGCATG CCCCCCCCCC CGAATTCGAC GTC
      GATCTGGGGG GGGGGCGTAC GGGGGGGGGG GCTTAAGCTG CAG
```

Figure 28: functional map and sequence of pMCS cloning vector

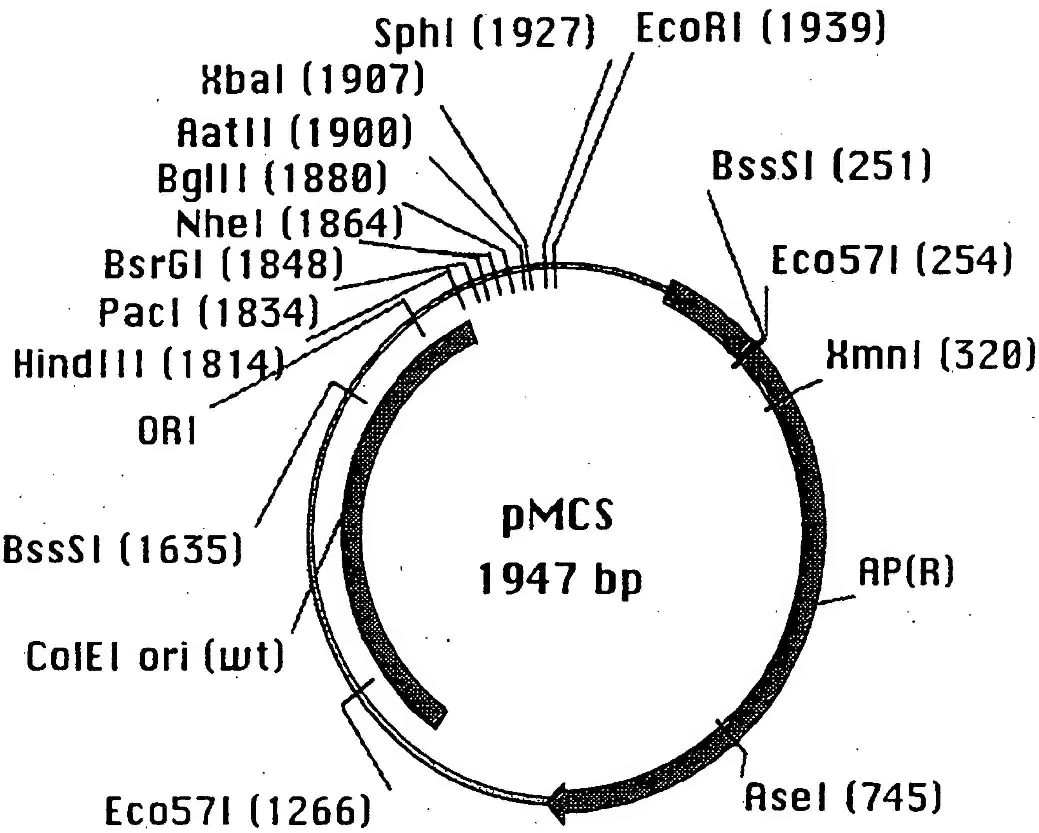


Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
  1  CAGGTGGCAC TTTTCGGGGA AATGTGCGCG GAACCCCTAT TTGTTTATTT
     GTCCACCGTG AAAAGCCCCT TTACACGCGC CTTGGGGATA AACAAATAAA

 51  TTCTAAATAC ATTCAAATAT GTATCCGCTC ATGAGACAAT AACCCTGATA
     AAGATTTATG TAAGTTTATA CATAGGCGAG TACTCTGTTA TTGGGACTAT

101  AATGCTTCAA TAATATTGAA AAAGGAAGAG TATGAGTATT CAACATTTCC
     TTACGAAGTT ATTATAACTT TTTCCTTCTC ATACTCATAA GTTGTAAAGG

151  GTGTCGCCCT TATTCCCTTT TTTGCGGCAT TTTGCCTTCC TGTTTTTGCT
     CACAGCGGGA ATAAGGGAAA AAACGCCGTA AAACGGAAGG ACAAAAACGA

                                      Eco57I
                                      ~~~~~~~
201  CACCCAGAAA CGCTGGTGAA AGTAAAAGAT GCTGAAGATC AGTTGGGTGC
     GTGGGTCTTT GCGACCACTT TCATTTTCTA CGACTTCTAG TCAACCCACG
                                                      BssSI
                                                          ~

251  ACGAGTGGGT TACATCGAAC TGGATCTCAA CAGCGGTAAG ATCCTTGAGA
     TGCTCACCCA ATGTAGCTTG ACCTAGAGTT GTCGCCATTC TAGGAACTCT
     BssSI
     ~~~~~~
```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
                   XmnI
                ~~~~~~~~~~~~
301  GTTTTCGCCC CGAAGAACGT TTTCCAATGA TGAGCACTTT TAAAGTTCTG
     CAAAAGCGGG GCTTCTTGCA AAAGGTTACT ACTCGTGAAA ATTTCAAGAC

351  CTATGTGGCG CGGTATTATC CCGTATTGAC GCCGGGCAAG AGCAACTCGG
     GATACACCGC GCCATAATAG GGCATAACTG CGGCCCGTTC TCGTTGAGCC

401  TCGCCGCATA CACTATTCTC AGAATGACTT GGTTGAGTAC TCACCAGTCA
     AGCGGCGTAT GTGATAAGAG TCTTACTGAA CCAACTCATG AGTGGTCAGT

451  CAGAAAAGCA TCTTACGGAT GGCATGACAG TAAGAGAATT ATGCAGTGCT
     GTCTTTTCGT AGAATGCCTA CCGTACTGTC ATTCTCTTAA TACGTCACGA

501  GCCATAACCA TGAGTGATAA CACTGCGGCC AACTTACTTC TGACAACGAT
     CGGTATTGGT ACTCACTATT GTGACGCCGG TTGAATGAAG ACTGTTGCTA

551  CGGAGGACCG AAGGAGCTAA CCGCTTTTTT GCACAACATG GGGGATCATG
     GCCTCCTGGC TTCCTCGATT GGCGAAAAAA CGTGTTGTAC CCCCTAGTAC

601  TAACTCGCCT TGATCGTTGG GAACCGGAGC TGAATGAAGC CATACCAAAC
     ATTGAGCGGA ACTAGCAACC CTTGGCCTCG ACTTACTTCG GTATGGTTTG

651  GACGAGCGTG ACACCACGAT GCCTGTAGCA ATGGCAACAA CGTTGCGCAA
```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
       CTGCTCGCAC TGTGGTGCTA CGGACATCGT TACCGTTGTT GCAACGCGTT

                                                   AseI
                                                  ~~~~~~~
 701   ACTATTAACT GGCGAACTAC TTACTCTAGC TTCCCGGCAA CAATTAATAG
       TGATAATTGA CCGCTTGATG AATGAGATCG AAGGGCCGTT GTTAATTATC

 751   ACTGGATGGA GGCGGATAAA GTTGCAGGAC CACTTCTGCG CTCGGCCCTT
       TGACCTACCT CCGCCTATTT CAACGTCCTG GTGAAGACGC GAGCCGGGAA

 801   CCGGCTGGCT GGTTTATTGC TGATAAATCT GGAGCCGGTG AGCGTGGGTC
       GGCCGACCGA CCAAATAACG ACTATTTAGA CCTCGGCCAC TCGCACCCAG

 851   TCGCGGTATC ATTGCAGCAC TGGGGCCAGA TGGTAAGCCC TCCCGTATCG
       AGCGCCATAG TAACGTCGTG ACCCCGGTCT ACCATTCGGG AGGGCATAGC

 901   TAGTTATCTA CACGACGGGG AGTCAGGCAA CTATGGATGA ACGAAATAGA
       ATCAATAGAT GTGCTGCCCC TCAGTCCGTT GATACCTACT TGCTTTATCT

 951   CAGATCGCTG AGATAGGTGC CTCACTGATT AAGCATTGGT AACTGTCAGA
       GTCTAGCGAC TCTATCCACG GAGTGACTAA TTCGTAACCA TTGACAGTCT

1001   CCAAGTTTAC TCATATATAC TTTAGATTGA TTTAAAACTT CATTTTTAAT
       GGTTCAAATG AGTATATATG AAATCTAACT AAATTTTGAA GTAAAAATTA
```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
1051   TTAAAAGGAT CTAGGTGAAG ATCCTTTTTG ATAATCTCAT GACCAAAATC
       AATTTTCCTA GATCCACTTC TAGGAAAAAC TATTAGAGTA CTGGTTTTAG

1101   CCTTAACGTG AGTTTTCGTT CCACTGAGCG TCAGACCCCG TAGAAAAGAT
       GGAATTGCAC TCAAAAGCAA GGTGACTCGC AGTCTGGGGC ATCTTTTCTA

1151   CAAAGGATCT TCTTGAGATC CTTTTTTTCT GCGCGTAATC TGCTGCTTGC
       GTTTCCTAGA AGAACTCTAG GAAAAAAAGA CGCGCATTAG ACGACGAACG

1201   AAACAAAAAA ACCACCGCTA CCAGCGGTGG TTTGTTTGCC GGATCAAGAG
       TTTGTTTTTT TGGTGGCGAT GGTCGCCACC AAACAAACGG CCTAGTTCTC

1251   CTACCAACTC TTTTTCCGAA GGTAACTGGC TTCAGCAGAG CGCAGATACC
       GATGGTTGAG AAAAAGGCTT CCATTGACCG AAGTCGTCTC GCGTCTATGG
                                           Eco57I
                                           ~~~~~~~~

1301   AAATACTGTC CTTCTAGTGT AGCCGTAGTT AGGCCACCAC TTCAAGAACT
       TTTATGACAG GAAGATCACA TCGGCATCAA TCCGGTGGTG AAGTTCTTGA

1351   CTGTAGCACC GCCTACATAC CTCGCTCTGC TAATCCTGTT ACCAGTGGCT
       GACATCGTGG CGGATGTATG GAGCGAGACG ATTAGGACAA TGGTCACCGA
```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
1401   GCTGCCAGTG GCGATAAGTC GTGTCTTACC GGGTTGGACT CAAGACGATA
        CGACGGTCAC CGCTATTCAG CACAGAATGG CCCAACCTGA GTTCTGCTAT

1451   GTTACCGGAT AAGGCGCAGC GGTCGGGCTG AACGGGGGGT TCGTGCACAC
        CAATGGCCTA TTCCGCGTCG CCAGCCCGAC TTGCCCCCCA AGCACGTGTG

1501   AGCCCAGCTT GGAGCGAACG ACCTACACCG AACTGAGATA CCTACAGCGT
        TCGGGTCGAA CCTCGCTTGC TGGATGTGGC TTGACTCTAT GGATGTCGCA

1551   GAGCTATGAG AAAGCGCCAC GCTTCCCGAA GGGAGAAAGG CGGACAGGTA
        CTCGATACTC TTTCGCGGTG CGAAGGGCTT CCCTCTTTCC GCCTGTCCAT

1601   TCCGGTAAGC GGCAGGGTCG GAACAGGAGA GCGCACGAGG GAGCTTCCAG
        AGGCCATTCG CCGTCCCAGC CTTGTCCTCT CGCGTGCTCC CTCGAAGGTC
                                           BssSI
                                          ~~~~~~~

1651   GGGGAAACGC CTGGTATCTT TATAGTCCTG TCGGGTTTCG CCACCTCTGA
        CCCCTTTGCG GACCATAGAA ATATCAGGAC AGCCCAAAGC GGTGGAGACT

1701   CTTGAGCGTC GATTTTTGTG ATGCTCGTCA GGGGGGCGGA GCCTATGGAA
        GAACTCGCAG CTAAAAACAC TACGAGCAGT CCCCCCGCCT CGGATACCTT

1751   AAACGCCAGC AACGCGGCCT TTTTACGGTT CCTGGCCTTT TGCTGGCCTT
```

Figure 28: functional map and sequence of pMCS cloning vector (continued)

```
         TTTGCGGTCG TTGCGCCGGA AAAATGCCAA GGACCGGAAA ACGACCGGAA

                     HindIII                 PacI            BsrGI
                     ~~~~~~~             ~~~~~~~~~~           ~~~~
1801     TTGCTCACAT GTAAGCTTCC CCCCCCCCTT AATTAACCCC CCCCCCTGTA
         AACGAGTGTA CATTCGAAGG GGGGGGGGAA TTAATTGGGG GGGGGGACAT

         BsrGI        NheI                 BglII             AatII
         ~~          ~~~~~~~             ~~~~~~~~          ~~~~~~~
1851     CACCCCCCCC CCGCTAGCCC CCCCCCCCAG ATCTCCCCCC CCCCGACGTC
         GTGGGGGGGG GGCGATCGGG GGGGGGGGTC TAGAGGGGGG GGGGCTGCAG

              XbaI                SphI              EcoRI
            ~~~~~~~~            ~~~~~~~           ~~~~~~~~
1901     CCCCCTCTAG ACCCCCCCCC CGCATGCCCC CCCCCCCGAA TTCACGT
         GGGGGAGATC TGGGGGGGGG GCGTACGGGG GGGGGGGCTT AAGTGCA
```

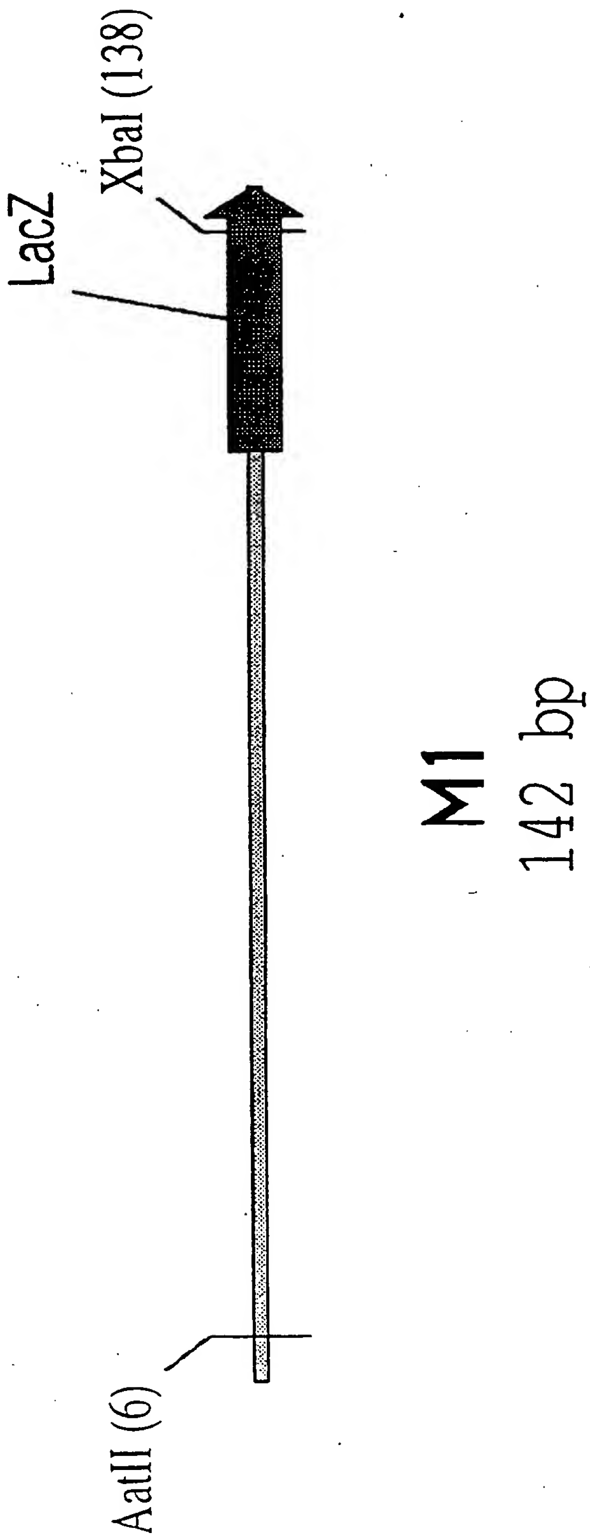


Figure 29: functional map and sequence of pCAL module M1

Figure 29: functional map and sequence of pCAL module M1

```
        AatII
       ~~~~~~~
  1    GACGTCTTAA TGTGAGTTAG CTCACTCATT AGGCACCCCA GGCTTTACAC
       CTGCAGAATT ACACTCAATC GAGTGAGTAA TCCGTGGGGT CCGAAATGTG

 51    TTTATGCTTC CGGCTCGTAT GTTGTGTGGA ATTGTGAGCG GATAACAATT
       AAATACGAAG GCCGAGCATA CAACACACCT TAACACTCGC CTATTGTTAA

                                           XbaI
                                          ~~~~~~~
101    TCACACAGGA AACAGCTATG ACCATGATTA CGAATTTCTA GA
       AGTGTGTCCT TTGTCGATAC TGGTACTAAT GCTTAAAGAT CT
```

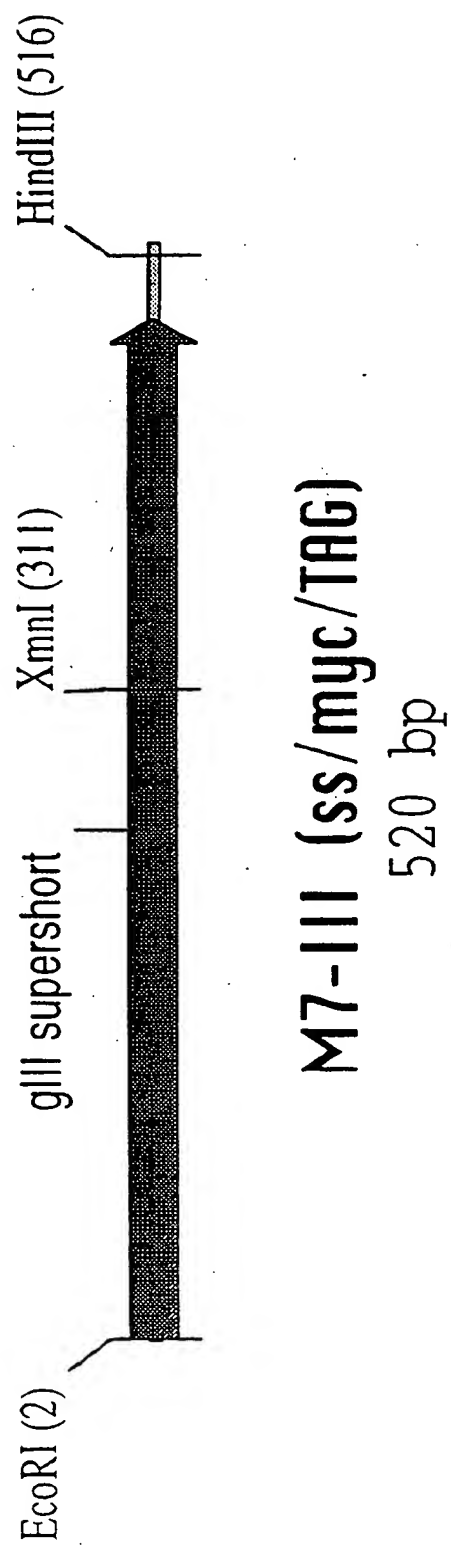


Figure 30: functional map and sequence of pCAL module M7-II

Figure 30: functional map and sequence of pCAL module M7-II (continued)

```
         EcoRI
        ~~~~~~~
  1     GAATTCGAGC AGAAGCTGAT CTCTGAGGAG GATCTGTAGG GTGGTGGCTC
        CTTAAGCTCG TCTTCGACTA GAGACTCCTC CTAGACATCC CACCACCGAG

 51     TGGTTCCGGT GATTTTGATT ATGAAAAGAT GGCAAACGCT AATAAGGGGG
        ACCAAGGCCA CTAAAACTAA TACTTTTCTA CCGTTTGCGA TTATTCCCCC

101     CTATGACCGA AAATGCCGAT GAAAACGCGC TACAGTCTGA CGCTAAAGGC
        GATACTGGCT TTTACGGCTA CTTTTGCGCG ATGTCAGACT GCGATTTCCG

151     AAACTTGATT CTGTCGCTAC TGATTACGGT GCTGCTATCG ATGGTTTCAT
        TTTGAACTAA GACAGCGATG ACTAATGCCA CGACGATAGC TACCAAAGTA

201     TGGTGACGTT TCCGGCCTTG CTAATGGTAA TGGTGCTACT GGTGATTTTG
        ACCACTGCAA AGGCCGGAAC GATTACCATT ACCACGATGA CCACTAAAAC

251     CTGGCTCTAA TTCCCAAATG GCTCAAGTCG GTGACGGTGA TAATTCACCT
        GACCGAGATT AAGGGTTTAC CGAGTTCAGC CACTGCCACT ATTAAGTGGA

                 XmnI
              ~~~~~~~~~~~~
301     TTAATGAATA ATTTCCGTCA ATATTTACCT TCCCTCCCTC AATCGGTTGA
        AATTACTTAT TAAAGGCAGT TATAAATGGA AGGGAGGGAG TTAGCCAACT
```

Figure 30: functional map and sequence of pCAL module M7-II (continued)

```
351   ATGTCGCCCT TTTGTCTTTG GCGCTGGTAA ACCATATGAA TTTTCTATTG
      TACAGCGGGA AAACAGAAAC CGCGACCATT TGGTATACTT AAAAGATAAC

401   ATTGTGACAA AATAAACTTA TTCCGTGGTG TCTTTGCGTT TCTTTTATAT
      TAACACTGTT TTATTTGAAT AAGGCACCAC AGAAACGCAA AGAAAATATA

451   GTTGCCACCT TTATGTATGT ATTTTCTACG TTTGCTAACA TACTGCGTAA
      CAACGGTGGA AATACATACA TAAAAGATGC AAACGATTGT ATGACGCATT

                       HindIII
                        ~~~~~~
501   TAAGGAGTCT TGATAAGCTT
      ATTCCTCAGA ACTATTCGAA
```

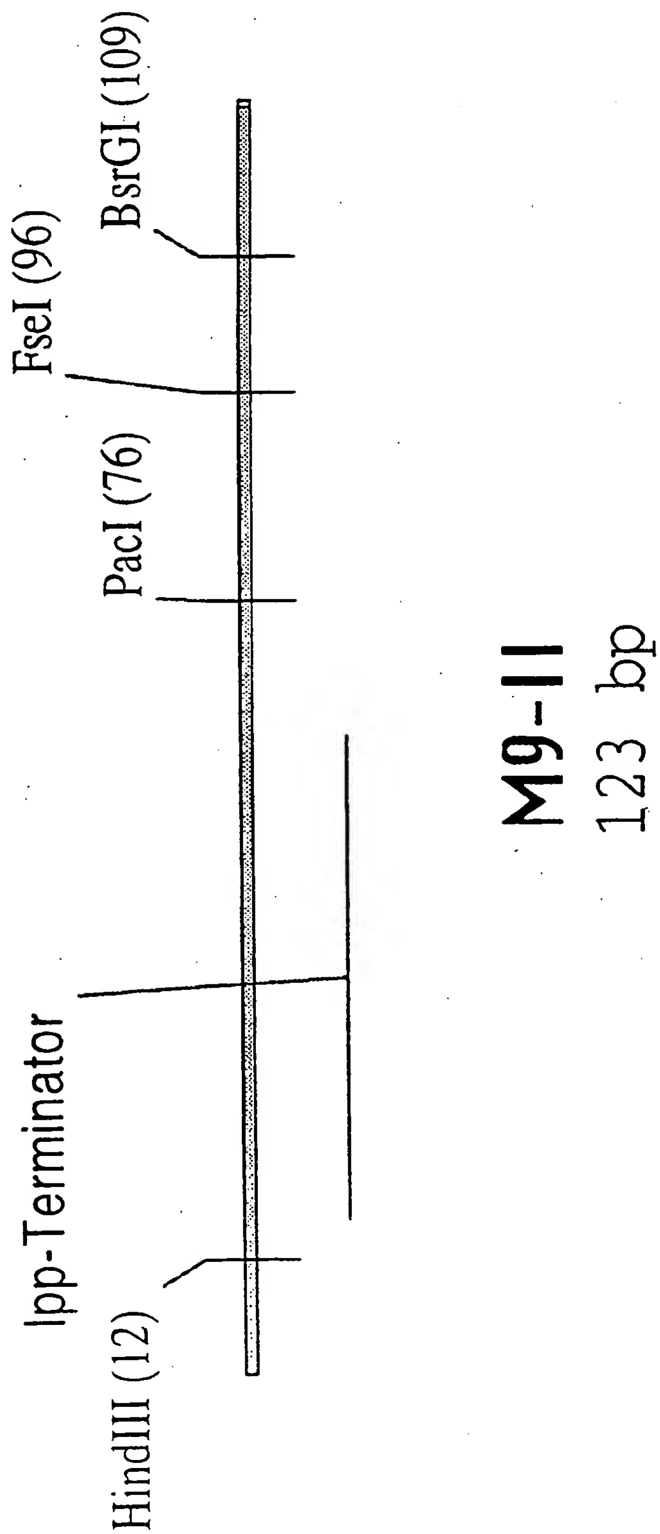


Figure 31: functional map and sequence of pCAL module M9-II

Figure 31: functional map and sequence of pCAL module M9-II (continued)

```
                 HindIII
                 ~~~~~~~
  1  GGGGGGGGGG AAGCTTGACC TGTGAAGTGA AAAATGGCGC AGATTGTGCG
     CCCCCCCCCC TTCGAACTGG ACACTTCACT TTTTACCGCG TCTAACACGC

                                PacI                 FseI
                            ~~~~~~~~~           ~~~~~~~~~~
 51  ACATTTTTTT TGTCTGCCGT TTAATTAAAG GGGGGGGGGG GCCGGCCTGG
     TGTAAAAAAA ACAGACGGCA AATTAATTTC CCCCCCCCCC CGGCCGGACC

             BsrGI
            ~~~~~~~~
101  GGGGGGGTGT ACAGGGGGGG GGG
     CCCCCCCACA TGTCCCCCCC CCC
```

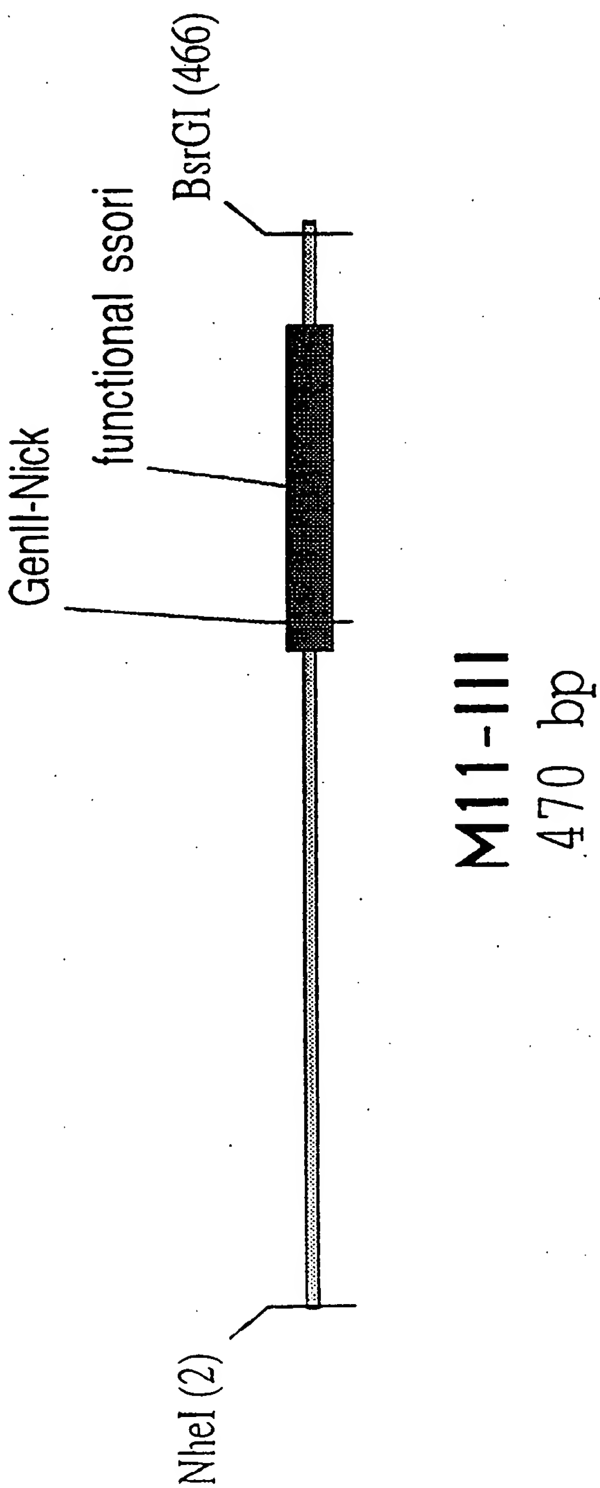


Figure 32: functional map and sequence of pCAL module M11-III

Figure 32: functional map and sequence of pCAL module M11-III (continued)

```
       NheI
      ~~~~~~~
  1   GCTAGCACGC GCCCTGTAGC GGCGCATTAA GCGCGGCGGG TGTGGTGGTT
      CGATCGTGCG CGGGACATCG CCGCGTAATT CGCGCCGCCC ACACCACCAA

 51   ACGCGCAGCG TGACCGCTAC ACTTGCCAGC GCCCTAGCGC CCGCTCCTTT
      TGCGCGTCGC ACTGGCGATG TGAACGGTCG CGGGATCGCG GGCGAGGAAA

101   CGCTTTCTTC CCTTCCTTTC TCGCCACGTT CGCCGGCTTT CCCCGTCAAG
      GCGAAAGAAG GGAAGGAAAG AGCGGTGCAA GCGGCCGAAA GGGGCAGTTC

151   CTCTAAATCG GGGCATCCCT TTAGGGTTCC GATTTAGTGC TTTACGGCAC
      GAGATTTAGC CCCGTAGGGA AATCCCAAGG CTAAATCACG AAATGCCGTG

201   CTCGACCCCA AAAAACTTGA TTAGGGTGAT GGTTCTCGTA GTGGGCCATC
      GAGCTGGGGT TTTTTGAACT AATCCCACTA CCAAGAGCAT CACCCGGTAG

251   GCCCTGATAG ACGGTTTTTC GCCCTTTGAC GTTGGAGTCC ACGTTCTTTA
      CGGGACTATC TGCCAAAAAG CGGGAAACTG CAACCTCAGG TGCAAGAAAT

301   ATAGTGGACT CTTGTTCCAA ACTGGAACAA CACTCAACCC TATCTCGGTC
      TATCACCTGA GAACAAGGTT TGACCTTGTT GTGAGTTGGG ATAGAGCCAG

351   TATTCTTTTG ATTTATAAGG GATTTTGCCG ATTTCGGCCT ATTGGTTAAA
```

Figure 32: functional map and sequence of pCAL module M11-III (continued)

```
     ATAAGAAAAC TAAATATTCC CTAAAACGGC TAAAGCCGGA TAACCAATTT

401  AAATGAGCTG ATTTAACAAA AATTTAACGC GAATTTTAAC AAAATATTAA
     TTTACTCGAC TAAATTGTTT TTAAATTGCG CTTAAAATTG TTTTATAATT

                     BsrGI
                    ~~~~~~~
451  CGTTTACAAT TTCATGTACA
     GCAAATGTTA AAGTACATGT
```

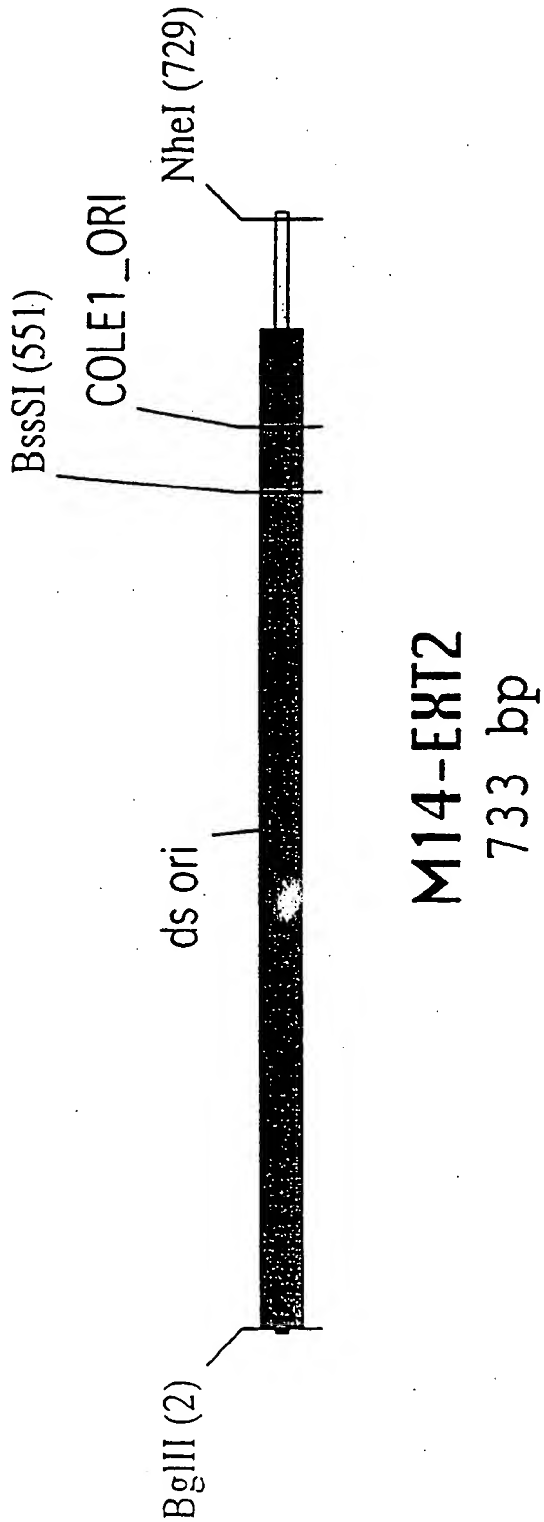


Figure 33: functional map and sequence of pCAL module M14-Ext2

Figure 33: functional map and sequence of pCAL module M14-Ext2 (continued)

```
      BglII
     ~~~~~~~
  1  AGATCTGACC AAAATCCCTT AACGTGAGTT TTCGTTCCAC TGAGCGTCAG
     TCTAGACTGG TTTTAGGGAA TTGCACTCAA AAGCAAGGTG ACTCGCAGTC

 51  ACCCCGTAGA AAAGATCAAA GGATCTTCTT GAGATCCTTT TTTTCTGCGC
     TGGGGCATCT TTTCTAGTTT CCTAGAAGAA CTCTAGGAAA AAAAGACGCG

101  GTAATCTGCT GCTTGCAAAC AAAAAAACCA CCGCTACCAG CGGTGGTTTG
     CATTAGACGA CGAACGTTTG TTTTTTTGGT GGCGATGGTC GCCACCAAAC

151  TTTGCCGGAT CAAGAGCTAC CAACTCTTTT TCCGAAGGTA ACTGGCTACA
     AAACGGCCTA GTTCTCGATG GTTGAGAAAA AGGCTTCCAT TGACCGATGT

201  GCAGAGCGCA GATACCAAAT ACTGTTCTTC TAGTGTAGCC GTAGTTAGGC
     CGTCTCGCGT CTATGGTTTA TGACAAGAAG ATCACATCGG CATCAATCCG

251  CACCACTTCA AGAACTCTGT AGCACCGCCT ACATACCTCG CTCTGCTAAT
     GTGGTGAAGT TCTTGAGACA TCGTGGCGGA TGTATGGAGC GAGACGATTA

301  CCTGTTACCA GTGGCTGCTG CCAGTGGCGA TAAGTCGTGT CTTACCGGGT
     GGACAATGGT CACCGACGAC GGTCACCGCT ATTCAGCACA GAATGGCCCA

351  TGGACTCAAG ACGATAGTTA CCGGATAAGG CGCAGCGGTC GGGCTGAACG
```

Figure 33: functional map and sequence of pCAL module M14-Ext2 (continued)

```
     ACCTGAGTTC TGCTATCAAT GGCCTATTCC GCGTCGCCAG CCCGACTTGC

401  GGGGGTTCGT GCACACAGCC CAGCTTGGAG CGAACGACCT ACACCGAACT
     CCCCCAAGCA CGTGTGTCGG GTCGAACCTC GCTTGCTGGA TGTGGCTTGA

451  GAGATACCTA CAGCGTGAGC TATGAGAAAG CGCCACGCTT CCCGAAGGGA
     CTCTATGGAT GTCGCACTCG ATACTCTTTC GCGGTGCGAA GGGCTTCCCT

501  GAAAGGCGGA CAGGTATCCG GTAAGCGGCA GGGTCGGAAC AGGAGAGCGC
     CTTTCCGCCT GTCCATAGGC CATTCGCCGT CCCAGCCTTG TCCTCTCGCG
                                                     BssSI
                                                         ~

551  ACGAGGGAGC TTCCAGGGGG AAACGCCTGG TATCTTTATA GTCCTGTCGG
     TGCTCCCTCG AAGGTCCCCC TTTGCGGACC ATAGAAATAT CAGGACAGCC
     BssSI
     ~~~~~

601  GTTTCGCCAC CTCTGACTTG AGCGTCGATT TTTGTGATGC TCGTCAGGGG
     CAAAGCGGTG GAGACTGAAC TCGCAGCTAA AAACACTACG AGCAGTCCCC

651  GGCGGAGCCT ATGGAAAAAC GCCAGCAACG CGGCCTTTTT ACGGTTCCTG
     CCGCCTCGGA TACCTTTTTG CGGTCGTTGC GCCGGAAAAA TGCCAAGGAC
```

Figure 33: functional map and sequence of pCAL module M14-Ext2 (continued)

```
                                        NheI
                                       ~~~~~~
701  GCCTTTTGCT GGCCTTTTGC TCACATGGCT AGC
     CGGAAAACGA CCGGAAAACG AGTGTACCGA TCG
```

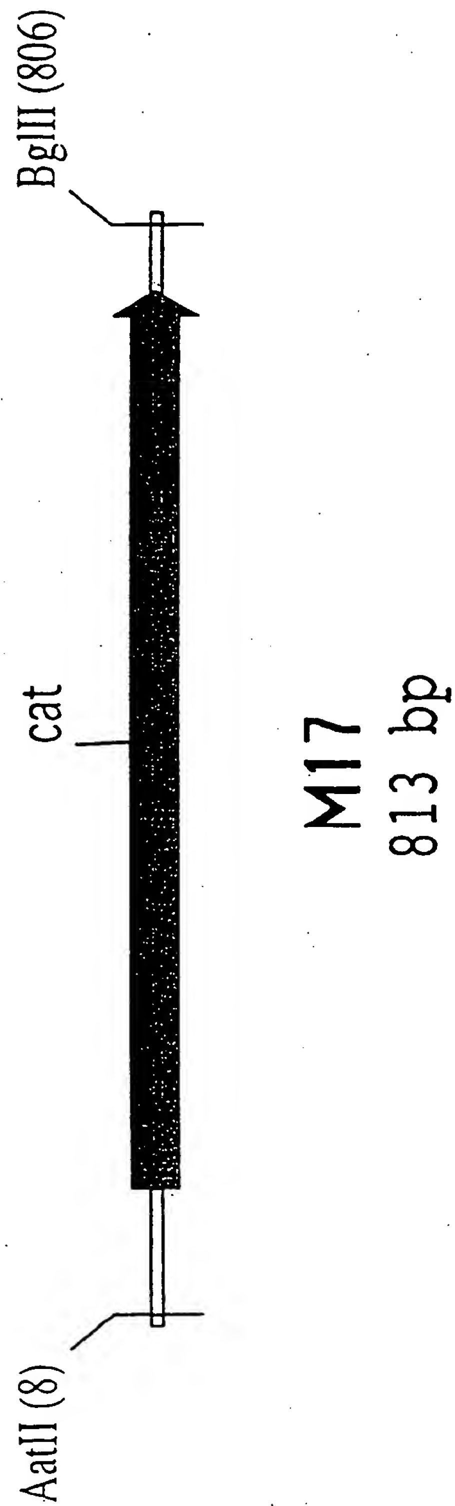


Figure 34: functional map and sequence of pCAL module M17

Figure 34: functional map and sequence of pCAL module M17 (continued)

```
          AatII
          ~~~~~~
  1  GGGACGTCGG GTGAGGTTCC AACTTTCACC ATAATGAAAT AAGATCACTA
     CCCTGCAGCC CACTCCAAGG TTGAAAGTGG TATTACTTTA TTCTAGTGAT

 51  CCGGGCGTAT TTTTTGAGTT ATCGAGATTT TCAGGAGCTA AGGAAGCTAA
     GGCCCGCATA AAAAACTCAA TAGCTCTAAA AGTCCTCGAT TCCTTCGATT

101  AATGGAGAAA AAAATCACTG GATATACCAC CGTTGATATA TCCCAATGGC
     TTACCTCTTT TTTTAGTGAC CTATATGGTG GCAACTATAT AGGGTTACCG

151  ATCGTAAAGA ACATTTTGAG GCATTTCAGT CAGTTGCTCA ATGTACCTAT
     TAGCATTTCT TGTAAAACTC CGTAAAGTCA GTCAACGAGT TACATGGATA

201  AACCAGACCG TTCAGCTGGA TATTACGGCC TTTTTAAAGA CCGTAAAGAA
     TTGGTCTGGC AAGTCGACCT ATAATGCCGG AAAAATTTCT GGCATTTCTT

251  AAATAAGCAC AAGTTTTATC CGGCCTTTAT TCACATTCTT GCCCGCCTGA
     TTTATTCGTG TTCAAAATAG GCCGGAAATA AGTGTAAGAA CGGGCGGACT

301  TGAATGCTCA CCCGGAGTTC CGTATGGCAA TGAAAGACGG TGAGCTGGTG
     ACTTACGAGT GGGCCTCAAG GCATACCGTT ACTTTCTGCC ACTCGACCAC

351  ATATGGGATA GTGTTCACCC TTGTTACACC GTTTTCCATG AGCAAACTGA
```

Figure 34: functional map and sequence of pCAL module M17 (continued)

```
     TATACCCTAT CACAAGTGGG AACAATGTGG CAAAAGGTAC TCGTTTGACT

401  AACGTTTTCA TCGCTCTGGA GTGAATACCA CGACGATTTC CGGCAGTTTC
     TTGCAAAAGT AGCGAGACCT CACTTATGGT GCTGCTAAAG GCCGTCAAAG

451  TACACATATA TTCGCAAGAT GTGGCGTGTT ACGGTGAAAA CCTGGCCTAT
     ATGTGTATAT AAGCGTTCTA CACCGCACAA TGCCACTTTT GGACCGGATA

501  TTCCCTAAAG GGTTTATTGA GAATATGTTT TTCGTCTCAG CCAATCCCTG
     AAGGGATTTC CCAAATAACT CTTATACAAA AAGCAGAGTC GGTTAGGGAC

551  GGTGAGTTTC ACCAGTTTTG ATTTAAACGT AGCCAATATG GACAACTTCT
     CCACTCAAAG TGGTCAAAAC TAAATTTGCA TCGGTTATAC CTGTTGAAGA

601  TCGCCCCCGT TTTCACTATG GGCAAATATT ATACGCAAGG CGACAAGGTG
     AGCGGGGGCA AAAGTGATAC CCGTTTATAA TATGCGTTCC GCTGTTCCAC

651  CTGATGCCGC TGGCGATTCA GGTTCATCAT GCCGTTTGTG ATGGCTTCCA
     GACTACGGCG ACCGCTAAGT CCAAGTAGTA CGGCAAACAC TACCGAAGGT

701  TGTCGGCAGA ATGCTTAATG AATTACAACA GTACTGCGAT GAGTGGCAGG
     ACAGCCGTCT TACGAATTAC TTAATGTTGT CATGACGCTA CTCACCGTCC

751  GCGGGGCGTA ATTTTTTTAA GGCAGTTATT GGGTGCCCTT AAACGCCTGG
```

Figure 34: functional map and sequence of pCAL module M17 (continued)

```
      CGCCCCGCAT TAAAAAAATT CCGTCAATAA CCCACGGGAA TTTGCGGACC

            BglII
           ~~~~~~~
801   TGCTAGATCT TCC
      ACGATCTAGA AGG
```

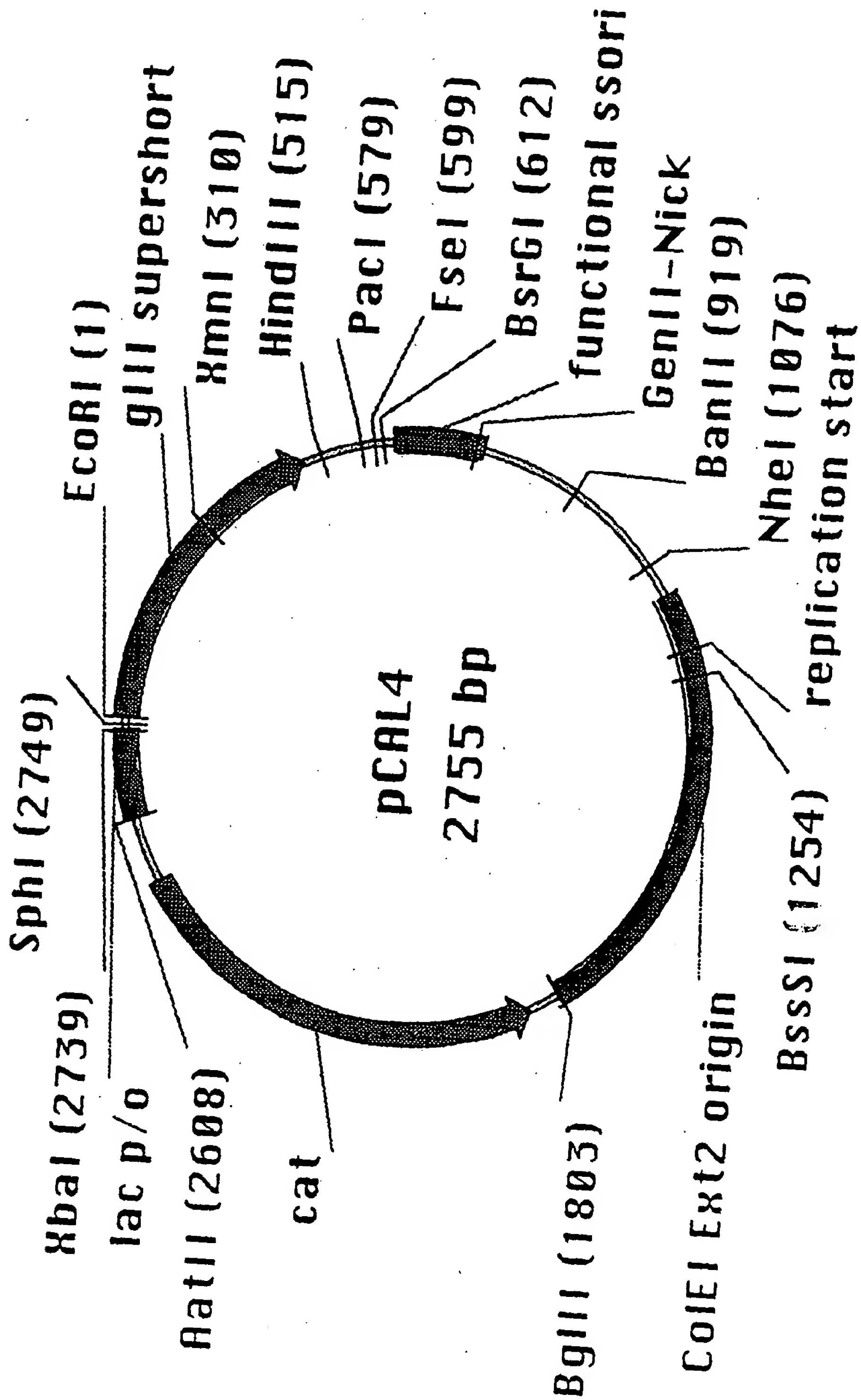


Figure 35: functional map and sequence of modular vector pCAL4

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
      EcoRI
      ~~~~~~
  1   AATTCGAGCA GAAGCTGATC TCTGAGGAGG ATCTGTAGGG TGGTGGCTCT
      TTAAGCTCGT CTTCGACTAG AGACTCCTCC TAGACATCCC ACCACCGAGA

 51   GGTTCCGGTG ATTTTGATTA TGAAAAGATG GCAAACGCTA ATAAGGGGGC
      CCAAGGCCAC TAAAACTAAT ACTTTTCTAC CGTTTGCGAT TATTCCCCCG

101   TATGACCGAA AATGCCGATG AAAACGCGCT ACAGTCTGAC GCTAAAGGCA
      ATACTGGCTT TTACGGCTAC TTTTGCGCGA TGTCAGACTG CGATTTCCGT

151   AACTTGATTC TGTCGCTACT GATTACGGTG CTGCTATCGA TGGTTTCATT
      TTGAACTAAG ACAGCGATGA CTAATGCCAC GACGATAGCT ACCAAAGTAA

201   GGTGACGTTT CCGGCCTTGC TAATGGTAAT GGTGCTACTG GTGATTTTGC
      CCACTGCAAA GGCCGGAACG ATTACCATTA CCACGATGAC CACTAAAACG

251   TGGCTCTAAT TCCCAAATGG CTCAAGTCGG TGACGGTGAT AATTCACCTT
      ACCGAGATTA AGGGTTTACC GAGTTCAGCC ACTGCCACTA TTAAGTGGAA

                XmnI
            ~~~~~~~~~~~~
301   TAATGAATAA TTTCCGTCAA TATTTACCTT CCCTCCCTCA ATCGGTTGAA
      ATTACTTATT AAAGGCAGTT ATAAATGGAA GGGAGGGAGT TAGCCAACTT
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
351  TGTCGCCCTT TTGTCTTTGG CGCTGGTAAA CCATATGAAT TTTCTATTGA
     ACAGCGGGAA AACAGAAACC GCGACCATTT GGTATACTTA AAAGATAACT

401  TTGTGACAAA ATAAACTTAT TCCGTGGTGT CTTTGCGTTT CTTTTATATG
     AACACTGTTT TATTTGAATA AGGCACCACA GAAACGCAAA GAAAATATAC

451  TTGCCACCTT TATGTATGTA TTTTCTACGT TTGCTAACAT ACTGCGTAAT
     AACGGTGGAA ATACATACAT AAAAGATGCA AACGATTGTA TGACGCATTA

                HindIII
                ~~~~~~
501  AAGGAGTCTT GATAAGCTTG ACCTGTGAAG TGAAAAATGG CGCAGATTGT
     TTCCTCAGAA CTATTCGAAC TGGACACTTC ACTTTTTACC GCGTCTAACA

                                PacI                FseI
                             ~~~~~~~~         ~~~~~~~~
551  GCGACATTTT TTTTGTCTGC CGTTTAATTA AAGGGGGGGG GGGGCCGGCC
     CGCTGTAAAA AAAACAGACG GCAAATTAAT TTCCCCCCCC CCCCGGCCGG

              BsrGI
              ~~~~~~
601  TGGGGGGGGG TGTACATGAA ATTGTAAACG TTAATATTTT GTTAAAATTC
     ACCCCCCCCC ACATGTACTT TAACATTTGC AATTATAAAA CAATTTTAAG
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
651   GCGTTAAATT TTTGTTAAAT CAGCTCATTT TTTAACCAAT AGGCCGAAAT
      CGCAATTTAA AAACAATTTA GTCGAGTAAA AAATTGGTTA TCCGGCTTTA

701   CGGCAAAATC CCTTATAAAT CAAAAGAATA GACCGAGATA GGGTTGAGTG
      GCCGTTTTAG GGAATATTTA GTTTTCTTAT CTGGCTCTAT CCCAACTCAC

751   TTGTTCCAGT TTGGAACAAG AGTCCACTAT TAAAGAACGT GGACTCCAAC
      AACAAGGTCA AACCTTGTTC TCAGGTGATA ATTTCTTGCA CCTGAGGTTG

801   GTCAAAGGGC GAAAAACCGT CTATCAGGGC GATGGCCCAC TACGAGAACC
      CAGTTTCCCG CTTTTT[illegible]GCA GATAGTCCCG CTACCGGGTG ATGCTCTTGG

851   ATCACCCTAA TCAAGTTTTT TGGGGTCGAG GTGCCGTAAA GCACTAAATC
      TAGTGGGATT AGTTCAAAAA ACCCCAGCTC CACGGCATTT CGTGATTTAG

                    BanII
                   ~~~~~~
901   GGAACCCTAA AGGGAGCCCC CGATTTAGAG CTTGACGGGG AAAGCCGGCG
      CCTTGGGATT TCCCTCGGGG GCTAAATCTC GAACTGCCCC TTTCGGCCGC

951   AACGTGGCGA GAAAGGAAGG GAAGAAAGCG AAAGGAGCGG GCGCTAGGGC
      TTGCACCGCT CTTTCCTTCC CTTCTTTCGC TTTCCTCGCC CGCGATCCCG
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
1001  GCTGGCAAGT GTAGCGGTCA CGCTGCGCGT AACCACCACA CCCGCCGCGC
      CGACCGTTCA CATCGCCAGT GCGACGCGCA TTGGTGGTGT GGGCGGCGCG

                                NheI
                               ~~~~~~~
1051  TTAATGCGCC GCTACAGGGC GCGTGCTAGC CATGTGAGCA AAAGGCCAGC
      AATTACGCGG CGATGTCCCG CGCACGATCG GTACACTCGT TTTCCGGTCG

1101  AAAAGGCCAG GAACCGTAAA AAGGCCGCGT TGCTGGCGTT TTTCCATAGG
      TTTTCCGGTC CTTGGCATTT TTCCGGCGCA ACGACCGCAA AAAGGTATCC

1151  CTCCGCCCCC CTGACGAGCA TCACAAAAAT CGACGCTCAA GTCAGAGGTG
      GAGGCGGGGG GACTGCTCGT AGTGTTTTTA GCTGCGAGTT CAGTCTCCAC

1201  GCGAAACCCG ACAGGACTAT AAAGATACCA GGCGTTTCCC CCTGGAAGCT
      CGCTTTGGGC TGTCCTGATA TTTCTATGGT CCGCAAAGGG GGACCTTCGA

        BssSI
      ~~~~~~~
1251  CCCTCGTGCG CTCTCCTGTT CCGACCCTGC CGCTTACCGG ATACCTGTCC
      GGGAGCACGC GAGAGGACAA GGCTGGGACG GCGAATGGCC TATGGACAGG

1301  GCCTTTCTCC CTTCGGGAAG CGTGGCGCTT TCTCATAGCT CACGCTGTAG
      CGGAAAGAGG GAAGCCCTTC GCACCGCGAA AGAGTATCGA GTGCGACATC
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
1351   GTATCTCAGT TCGGTGTAGG TCGTTCGCTC CAAGCTGGGC TGTGTGCACG
       CATAGAGTCA AGCCACATCC AGCAAGCGAG GTTCGACCCG ACACACGTGC

1401   AACCCCCCGT TCAGCCCGAC CGCTGCGCCT TATCCGGTAA CTATCGTCTT
       TTGGGGGGCA AGTCGGGCTG GCGACGCGGA ATAGGCCATT GATAGCAGAA

1451   GAGTCCAACC CGGTAAGACA CGACTTATCG CCACTGGCAG CAGCCACTGG
       CTCAGGTTGG GCCATTCTGT GCTGAATAGC GGTGACCGTC GTCGGTGACC

1501   TAACAGGATT AGCAGAGCGA GGTATGTAGG CGGTGCTACA GAGTTCTTGA
       ATTGTCCTAA TCGTCTCGCT CCATACATCC GCCACGATGT CTCAAGAACT

1551   AGTGGTGGCC TAACTACGGC TACACTAGAA GAACAGTATT TGGTATCTGC
       TCACCACCGG ATTGATGCCG ATGTGATCTT CTTGTCATAA ACCATAGACG

1601   GCTCTGCTGT AGCCAGTTAC CTTCGGAAAA AGAGTTGGTA GCTCTTGATC
       CGAGACGACA TCGGTCAATG GAAGCCTTTT TCTCAACCAT CGAGAACTAG

1651   CGGCAAACAA ACCACCGCTG GTAGCGGTGG TTTTTTTGTT TGCAAGCAGC
       GCCGTTTGTT TGGTGGCGAC CATCGCCACC AAAAAAACAA ACGTTCGTCG

1701   AGATTACGCG CAGAAAAAAA GGATCTCAAG AAGATCCTTT GATCTTTTCT
       TCTAATGCGC GTCTTTTTTT CCTAGAGTTC TTCTAGGAAA CTAGAAAAGA
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
1751   ACGGGGTCTG ACGCTCAGTG GAACGAAAAC TCACGTTAAG GGATTTTGGT
       TGCCCCAGAC TGCGAGTCAC CTTGCTTTTG AGTGCAATTC CCTAAAACCA

          BglII
         ~~~~~~~
1801   CAGATCTAGC ACCAGGCGTT TAAGGGCACC AATAACTGCC TTAAAAAAAT
       GTCTAGATCG TGGTCCGCAA ATTCCCGTGG TTATTGACGG AATTTTTTTA

1851   TACGCCCCGC CCTGCCACTC ATCGCAGTAC TGTTGTAATT CATTAAGCAT
       ATGCGGGGCG GGACGGTGAG TAGCGTCATG ACAACATTAA GTAATTCGTA

1901   TCTGCCGACA TGGAAGCCAT CACAAACGGC ATGATGAACC TGAATCGCCA
       AGACGGCTGT ACCTTCGGTA GTGTTTGCCG TACTACTTGG ACTTAGCGGT

1951   GCGGCATCAG CACCTTGTCG CCTTGCGTAT AATATTTGCC CATAGTGAAA
       CGCCGTAGTC GTGGAACAGC GGAACGCATA TTATAAACGG GTATCACTTT

2001   ACGGGGGCGA AGAAGTTGTC CATATTGGCT ACGTTTAAAT CAAAACTGGT
       TGCCCCCGCT TCTTCAACAG GTATAACCGA TGCAAATTTA GTTTTGACCA

2051   GAAACTCACC CAGGGATTGG CTGAGACGAA AAACATATTC TCAATAAACC
       CTTTGAGTGG GTCCCTAACC GACTCTGCTT TTTGTATAAG AGTTATTTGG
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
2101   CTTTAGGGAA ATAGGCCAGG TTTTCACCGT AACACGCCAC ATCTTGCGAA
       GAAATCCCTT TATCCGGTCC AAAAGTGGCA TTGTGCGGTG TAGAACGCTT

2151   TATATGTGTA GAAACTGCCG GAAATCGTCG TGGTATTCAC TCCAGAGCGA
       ATATACACAT CTTTGACGGC CTTTAGCAGC ACCATAAGTG AGGTCTCGCT

2201   TGAAAACGTT TCAGTTTGCT CATGGAAAAC GGTGTAACAA GGGTGAACAC
       ACTTTTGCAA AGTCAAACGA GTACCTTTTG CCACATTGTT CCCACTTGTG

2251   TATCCCATAT CACCAGCTCA CCGTCTTTCA TTGCCATACG GAACTCCGGG
       ATAGGGTATA GTGGTCGAGT GGCAGAAAGT AACGGTATGC CTTGAGGCCC

2301   TGAGCATTCA TCAGGCGGGC AAGAATGTGA ATAAAGGCCG GATAAAACTT
       ACTCGTAAGT AGTCCGCCCG TTCTTACACT TATTTCCGGC CTATTTTGAA

2351   GTGCTTATTT TTCTTTACGG TCTTTAAAAA GGCCGTAATA TCCAGCTGAA
       CACGAATAAA AAGAAATGCC AGAAATTTTT CCGGCATTAT AGGTCGACTT

2401   CGGTCTGGTT ATAGGTACAT TGAGCAACTG ACTGAAATGC CTCAAAATGT
       GCCAGACCAA TATCCATGTA ACTCGTTGAC TGACTTTACG GAGTTTTACA

2451   TCTTTACGAT GCCATTGGGA TATATCAACG GTGGTATATC CAGTGATTTT
       AGAAATGCTA CGGTAACCCT ATATAGTTGC CACCATATAG GTCACTAAAA
```

Figure 35: functional map and sequence of modular vector pCAL4 (continued)

```
2501   TTTCTCCATT TTAGCTTCCT TAGCTCCTGA AAATCTCGAT AACTCAAAAA
       AAAGAGGTAA AATCGAAGGA ATCGAGGACT TTTAGAGCTA TTGAGTTTTT

2551   ATACGCCCGG TAGTGATCTT ATTTCATTAT GGTGAAAGTT GGAACCTCAC
       TATGCGGGCC ATCACTAGAA TAAAGTAATA CCACTTTCAA CCTTGGAGTG

          AatII
         ~~~~~~~
2601   CCGACGTCTA ATGTGAGTTA GCTCACTCAT TAGGCACCCC AGGCTTTACA
       GGCTGCAGAT TACACTCAAT CGAGTGAGTA ATCCGTGGGG TCCGAAATGT

2651   CTTTATGCTT CCGGCTCGTA TGTTGTGTGG AATTGTGAGC GGATAACAAT
       GAAATACGAA GGCCGAGCAT ACAACACACC TTAACACTCG CCTATTGTTA

                                            XbaI    SphI
                                           ~~~~~~~~~~~~~~
2701   TTCACACAGG AAACAGCTAT GACCATGATT ACGAATTTCT AGAGCATGCG
       AAGTGTGTCC TTTGTCGATA CTGGTACTAA TGCTTAAAGA TCTCGTACGC

      EcoRI

2751   GGGGG
       CCCCC
```

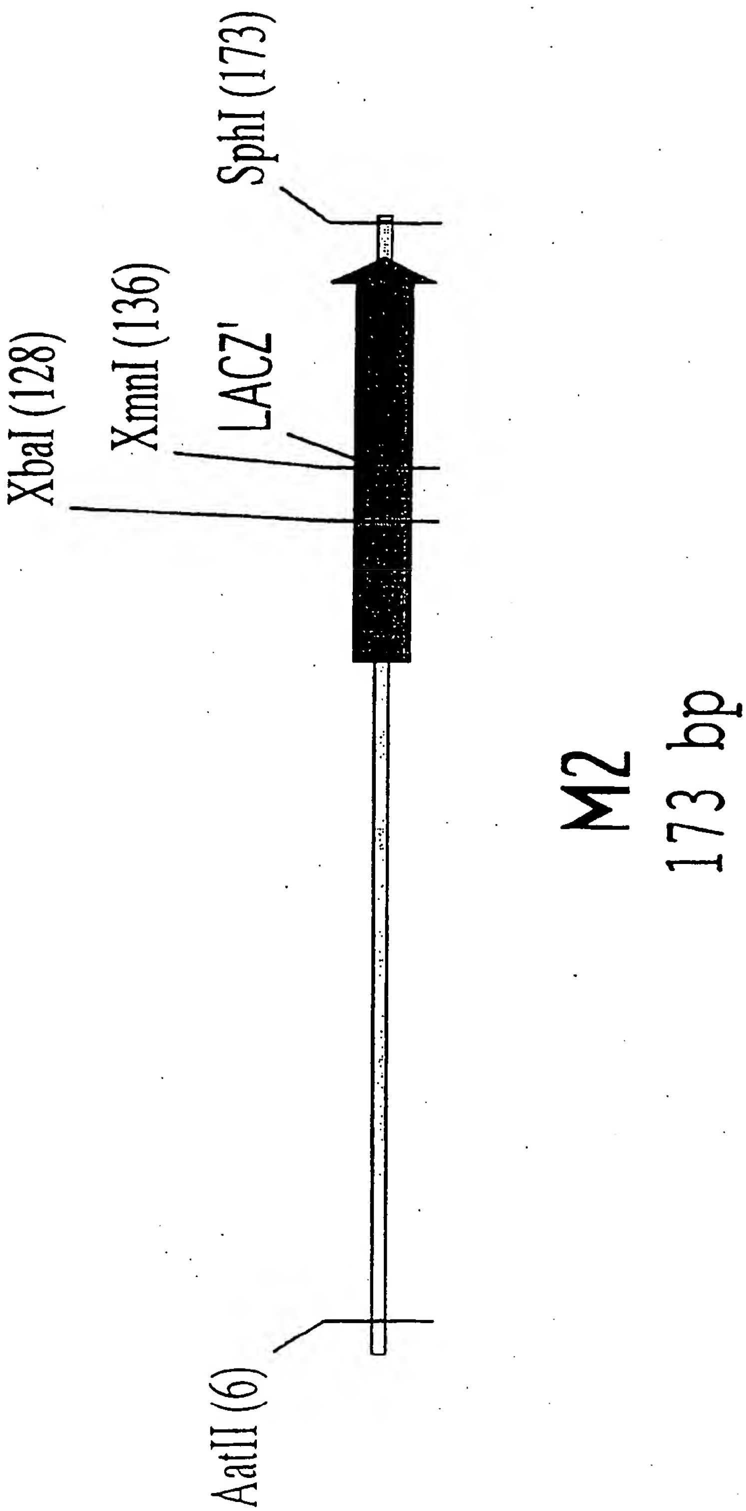


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 2:

```
      AatII
      ~~~~~~
  1   GACGTCTTAA TGTGAGTTAG CTCACTCATT AGGCACCCCA GGCTTTACAC
      CTGCAGAATT ACACTCAATC GAGTGAGTAA TCCGTGGGGT CCGAAATGTG

 51   TTTATGCTTC CGGCTCGTAT GTTGTGTGGA ATTGTGAGCG GATAACAATT
      AAATACGAAG GCCGAGCATA CAACACACCT TAACACTCGC CTATTGTTAA

                                           XmnI
                                         ~~~~~~~~~~~
                                    XbaI
                                  ~~~~~~~~
101   TCACACAGGA AACAGCTATG ACCATGTCTA GAATAACTTC GTATAATGTA
      AGTGTGTCCT TTGTCGATAC TGGTACAGAT CTTATTGAAG CATATTACAT

                         SphI
                        ~~~~~~
151   CGCTATACGA AGTTATCGCA TGC
      GCGATATGCT TCAATAGCGT ACG
```

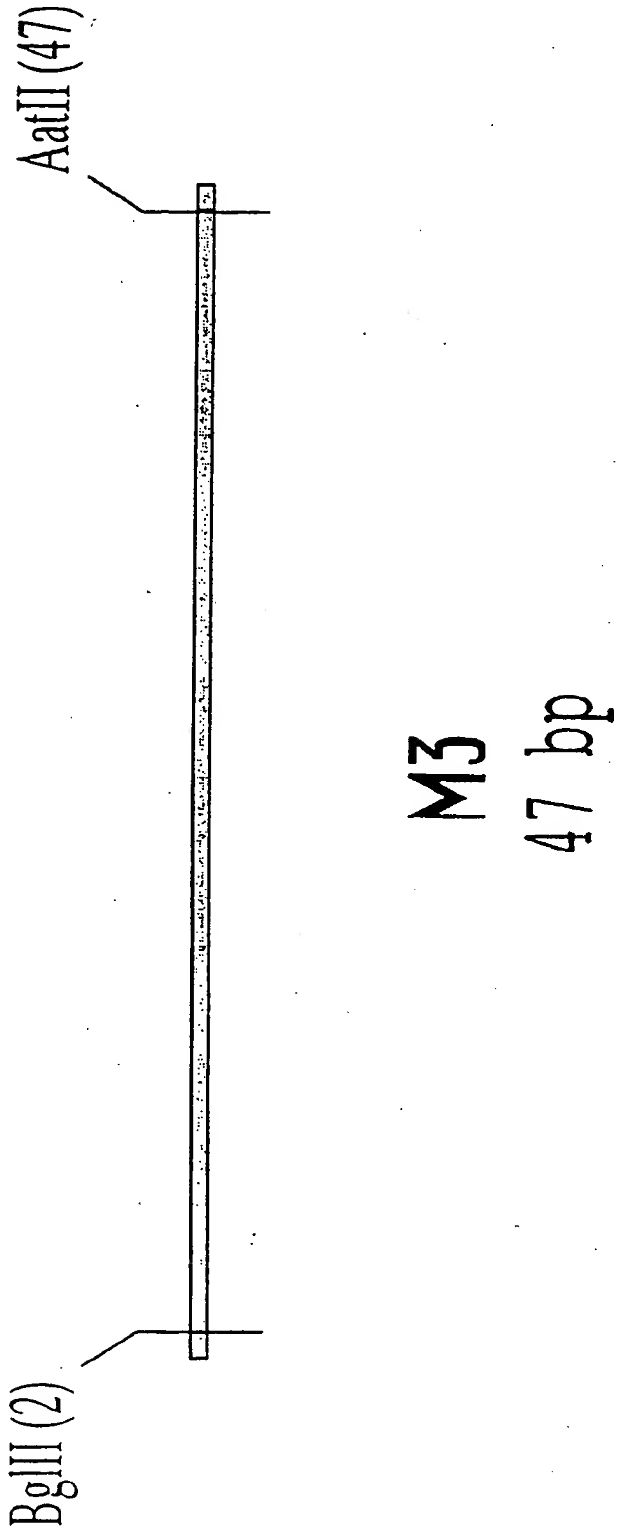


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 3:

```
      BglII                                              AatII
      ~~~~~~                                             ~~~~~~
1     AGATCTCATA ACTTCGTATA ATGTATGCTA TACGAAGTTA TGACGTC
      TCTAGAGTAT TGAAGCATAT TACATACGAT ATGCTTCAAT ACTGCAG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

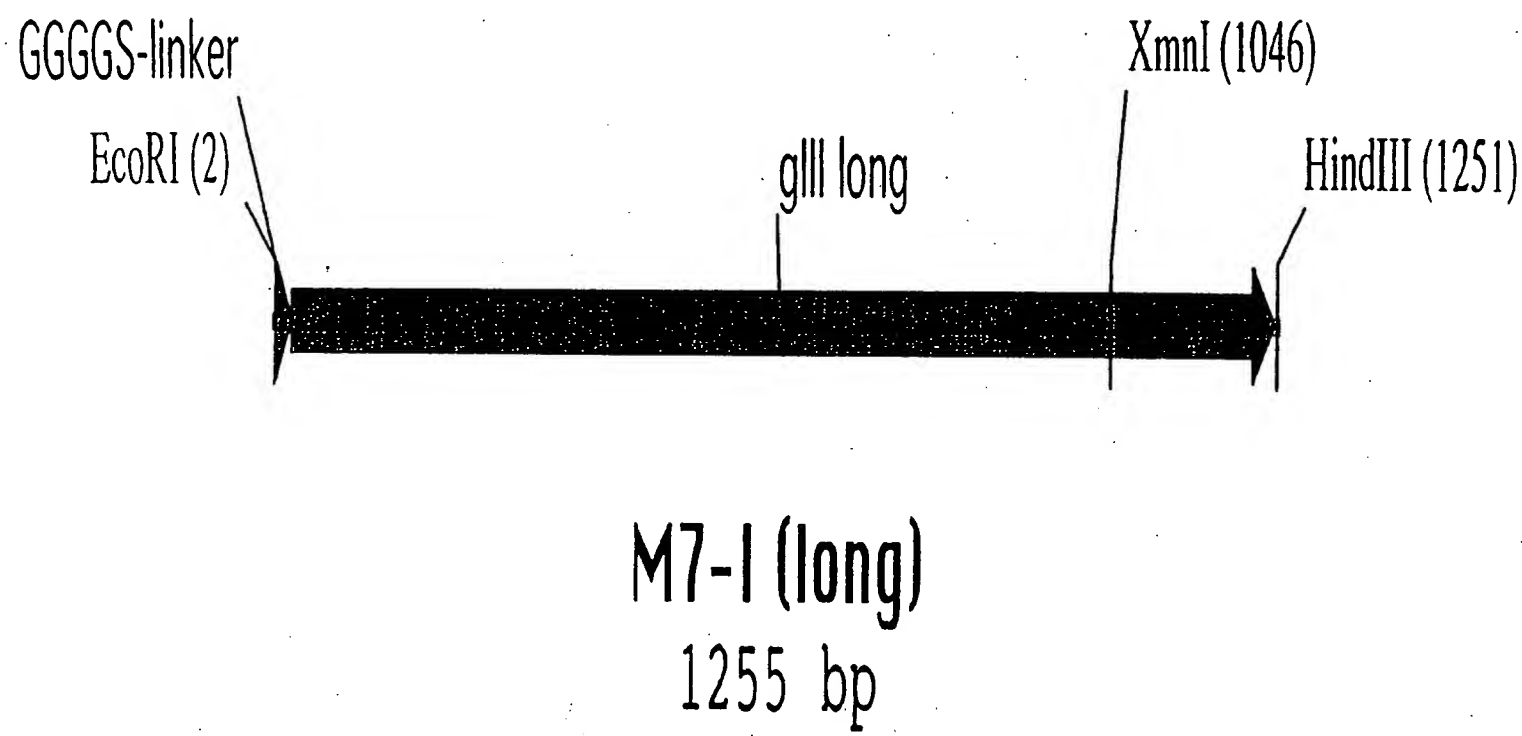


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 7-I (long):

```
             EcoRI
             ~~~~~~~
  1   GAATTCGGTG GTGGTGGATC TGCGTGCGCT GAAACGGTTG AAAGTTGTTT
      CTTAAGCCAC CACCACCTAG ACGCACGCGA CTTTGCCAAC TTTCAACAAA

 51   AGCAAAATCC CATACAGAAA ATTCATTTAC TAACGTCTGG AAAGACGACA
      TCGTTTTAGG GTATGTCTTT TAAGTAAATG ATTGCAGACC TTTCTGCTGT

101   AAACTTTAGA TCGTTACGCT AACTATGAGG GCTGTCTGTG GAATGCTACA
      TTTGAAATCT AGCAATGCGA TTGATACTCC CGACAGACAC CTTACGATGT

151   GGCGTTGTAG TTTGTACTGG TGACGAAACT CAGTGTTACG GTACATGGGT
      CCGCAACATC AAACATGACC ACTGCTTTGA GTCACAATGC CATGTACCCA

201   TCCTATTGGG CTTGCTATCC CTGAAAATGA GGGTGGTGGC TCTGAGGGTG
      AGGATAACCC GAACGATAGG GACTTTTACT CCCACCACCG AGACTCCCAC

251   GCGGTTCTGA GGGTGGCGGT TCTGAGGGTG GCGGTACTAA ACCTCCTGAG
      CGCCAAGACT CCCACCGCCA AGACTCCCAC CGCCATGATT TGGAGGACTC

301   TACGGTGATA CACCTATTCC GGGCTATACT TATATCAACC CTCTCGACGG
      ATGCCACTAT GTGGATAAGG CCCGATATGA ATATAGTTGG GAGAGCTGCC
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
351  CACTTATCCG CCTGGTACTG AGCAAAACCC CGCTAATCCT AATCCTTCTC
     GTGAATAGGC GGACCATGAC TCGTTTTGGG GCGATTAGGA TTAGGAAGAG

401  TTGAGGAGTC TCAGCCTCTT AATACTTTCA TGTTTCAGAA TAATAGGTTC
     AACTCCTCAG AGTCGGAGAA TTATGAAAGT ACAAAGTCTT ATTATCCAAG

451  CGAAATAGGC AGGGGGCATT AACTGTTTAT ACGGGCACTG TTACTCAAGG
     GCTTTATCCG TCCCCCGTAA TTGACAAATA TGCCCGTGAC AATGAGTTCC

501  CACTGACCCC GTTAAAACTT ATTACCAGTA CACTCCTGTA TCATCAAAAG
     GTGACTGGGG CAATTTTGAA TAATGGTCAT GTGAGGACAT AGTAGTTTTC

551  CCATGTATGA CGCTTACTGG AACGGTAAAT TCAGAGACTG CGCTTTCCAT
     GGTACATACT GCGAATGACC TTGCCATTTA AGTCTCTGAC GCGAAAGGTA

601  TCTGGCTTTA ATGAGGATTT ATTTGTTTGT GAATATCAAG GCCAATCGTC
     AGACCGAAAT TACTCCTAAA TAAACAAACA CTTATAGTTC CGGTTAGCAG

651  TGACCTGCCT CAACCTCCTG TCAATGCTGG CGGCGGCTCT GGTGGTGGTT
     ACTGGACGGA GTTGGAGGAC AGTTACGACC GCCGCCGAGA CCACCACCAA

701  CTGGTGGCGG CTCTGAGGGT GGTGGCTCTG AGGGTGGCGG TTCTGAGGGT
     GACCACCGCC GAGACTCCCA CCACCGAGAC TCCCACCGCC AAGACTCCCA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
 751  GGCGGCTCTG AGGGAGGCGG TTCCGGTGGT GGCTCTGGTT CCGGTGATTT
      CCGCCGAGAC TCCCTCCGCC AAGGCCACCA CCGAGACCAA GGCCACTAAA

 801  TGATTATGAA AAGATGGCAA ACGCTAATAA GGGGGCTATG ACCGAAAATG
      ACTAATACTT TTCTACCGTT TGCGATTATT CCCCCGATAC TGGCTTTTAC

 851  CCGATGAAAA CGCGCTACAG TCTGACGCTA AAGGCAAACT TGATTCTGTC
      GGCTACTTTT GCGCGATGTC AGACTGCGAT TTCCGTTTGA ACTAAGACAG

 901  GCTACTGATT ACGGTGCTGC TATCGATGGT TTCATTGGTG ACGTTTCCGG
      CGATGACTAA TGCCACGACG ATAGCTACCA AAGTAACCAC TGCAAAGGCC

 951  CCTTGCTAAT GGTAATGGTG CTACTGGTGA TTTTGCTGGC TCTAATTCCC
      GGAACGATTA CCATTACCAC GATGACCACT AAAACGACCG AGATTAAGGG

                                                 XmnI
                                              ~~~~~~~~~~
1001  AAATGGCTCA AGTCGGTGAA GGTGATAATT CACCTTTAAT GAATAATTTC
      TTTACCGAGT TCAGCCACTT CCACTATTAA GTGGAAATTA CTTATTAAAG

1051  CGTCAATATT TACCTTCCAT CCCTCAATCG GTTGAATGTC GCCCTTTTGT
      GCAGTTATAA ATGGAAGGTA GGGAGTTAGC CAACTTACAG CGGGAAAACA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1101  CTTTGGCGCT GGTAAACCCT ATGAATTTTC TATTGATTGT GACAAAATAA
      GAAACCGCGA CCATTTGGGA TACTTAAAAG ATAACTAACA CTGTTTTATT

1151  ACTTATTCCG TGGTGTCTTT GCGTTTCTTT TATATGTTGC CACCTTTATG
      TGAATAAGGC ACCACAGAAA CGCAAAGAAA ATATACAACG GTGGAAATAC

                                                   HindIII
                                                         ~
1201  TATGTATTTT CTACGTTTGC TAACATACTG CGTAATAAGG AGTCTTGATA
      ATACATAAAA GATGCAAACG ATTGTATGAC GCATTATTCC TCAGAACTAT

      HindI
      ~~~~~
1251  AGCTT
      TCGAA
```

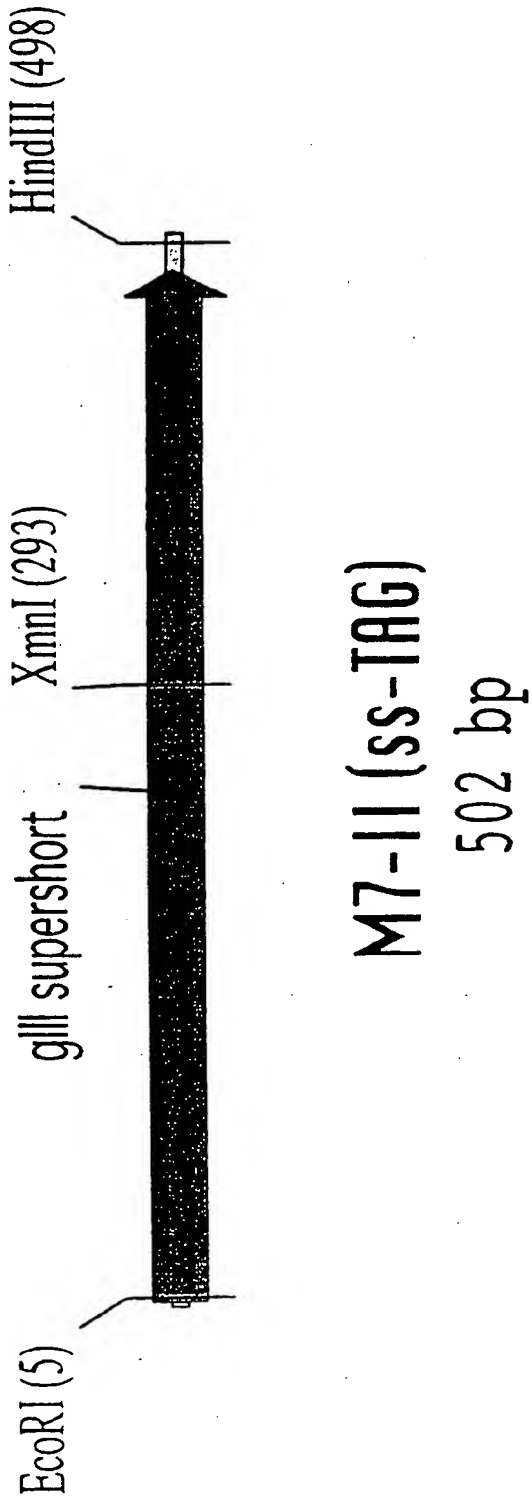


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 7-II (ss-TAG):

```
          EcoRI
          ~~~~~~~
  1   CGGGAATTCG GAGGCGGTTC CGGTGGTGGC TCTGGTTCCG GTGATTTTGA
      GCCCTTAAGC CTCCGCCAAG GCCACCACCG AGACCAAGGC CACTAAAACT

 51   TTATGAAAAG ATGGCAAACG CTAATAAGGG GGCTATGACC GAAAATGCCG
      AATACTTTTC TACCGTTTGC GATTATTCCC CCGATACTGG CTTTTACGGC

101   ATGAAAAACGC GCTACAGTCT GACGCTAAAG GCAAACTTGA TTCTGTCGCT
      TACTTTTGCG CGATGTCAGA CTGCGATTTC CGTTTGAACT AAGACAGCGA

151   ACTGATTACG GTGCTGCTAT CGATGGTTTC ATTGGTGACG TTTCCGGCCT
      TGACTAATGC CACGACGATA GCTACCAAAG TAACCACTGC AAAGGCCGGA

201   TGCTAATGGT AATGGTGCTA CTGGTGATTT TGCTGGCTCT AATTCCCAAA
      ACGATTACCA TTACCACGAT GACCACTAAA ACGACCGAGA TTAAGGGTTT

                                                 XmnI
                                             ~~~~~~~~~~~~
251   TGGCTCAAGT CGGTGACGGT GATAATTCAC CTTTAATGAA TAATTTCCGT
      ACCGAGTTCA GCCACTGCCA CTATTAAGTG GAAATTACTT ATTAAAGGCA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
301   CAATATTTAC CTTCCCTCCC TCAATCGGTT GAATGTCGCC CTTTTGTCTT
      GTTATAAATG GAAGGGAGGG AGTTAGCCAA CTTACAGCGG GAAAACAGAA

351   TGGCGCTGGT AAACCATATG AATTTTCTAT TGATTGTGAC AAAATAAACT
      ACCGCGACCA TTTGGTATAC TTAAAAGATA ACTAACACTG TTTTATTTGA

401   TATTCCGTGG TGTCTTTGCG TTTCTTTTAT ATGTTGCCAC CTTTATGTAT
      ATAAGGCACC ACAGAAACGC AAAGAAAATA TACAACGGTG GAAATACATA

                                                   HindIII
                                                      ~~~~
451   GTATTTTCTA CGTTTGCTAA CATACTGCGT AATAAGGAGT CTTGATAAGC
      CATAAAAGAT GCAAACGATT GTATGACGCA TTATTCCTCA GAACTATTCG

      Hi
      ~
501   TT
      AA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

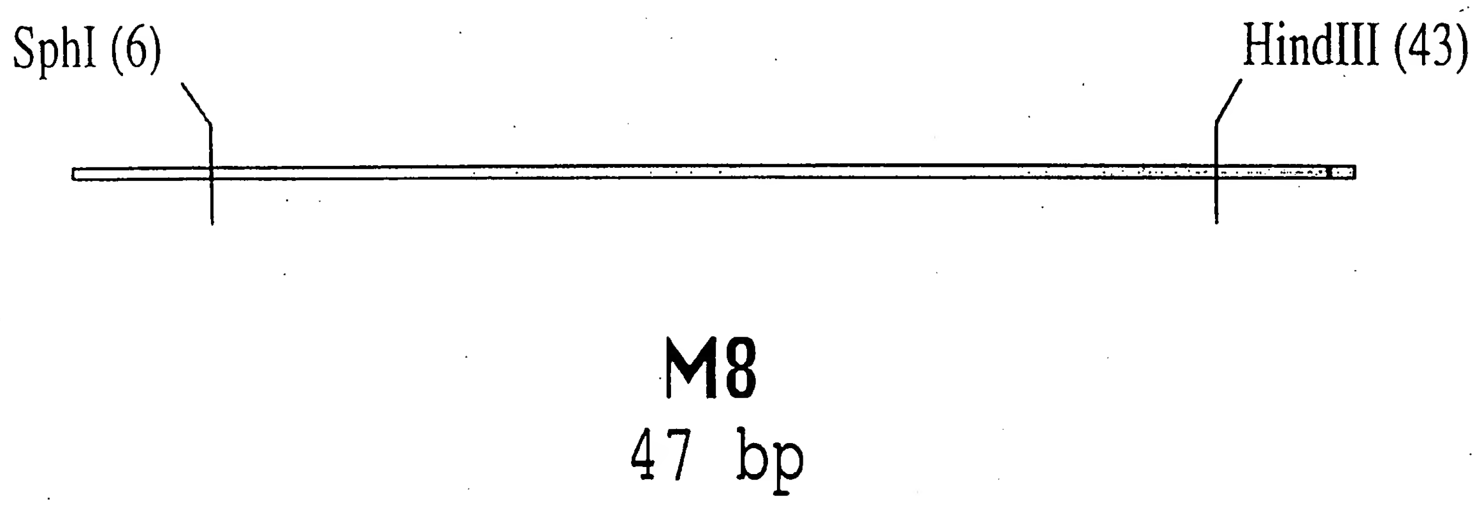


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 8:

```
      SphI                                          HindIII
     ~~~~~~                                          ~~~~~
1    GCATGCCATA ACTTCGTATA ATGTACGCTA TACGAAGTTA TAAGCTT
     CGTACGGTAT TGAAGCATAT TACATGCGAT ATGCTTCAAT ATTCGAA
```

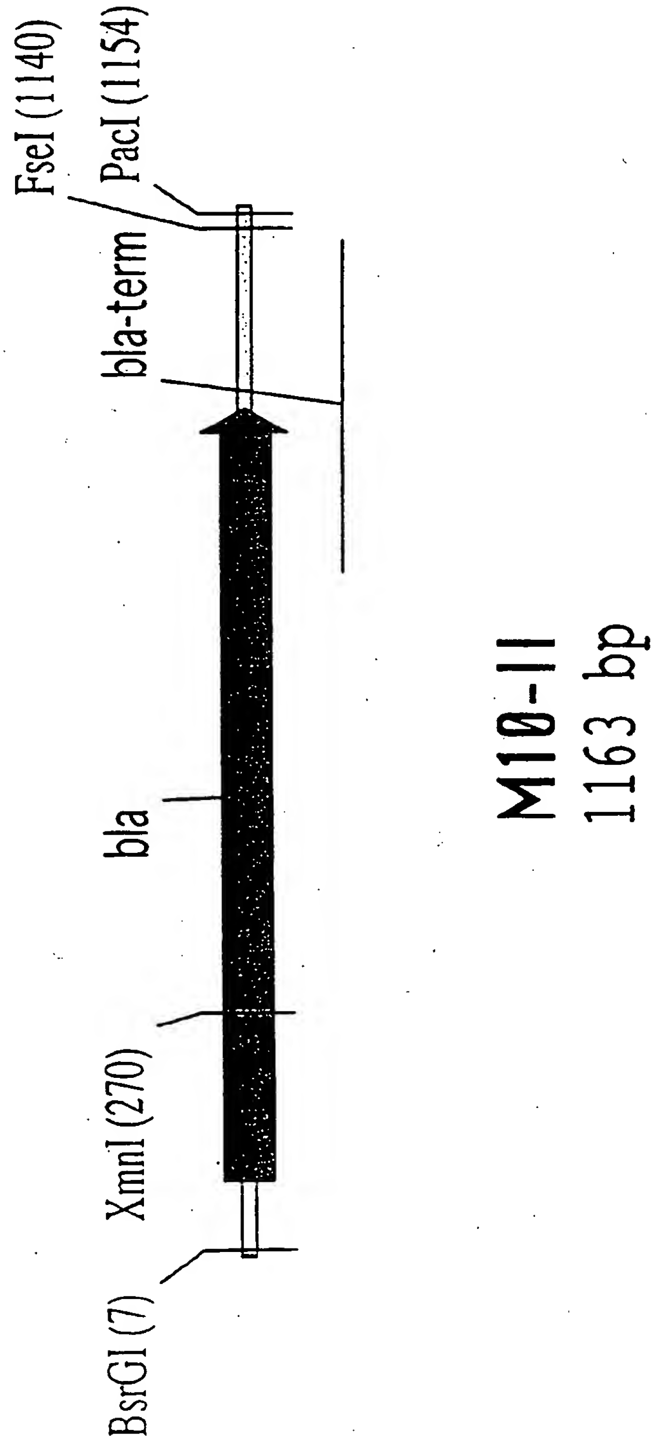


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 10-II:

```
              BsrGI
            ~~~~~~~~
  1   GGGGGTGTAC ATTCAAATAT GTATCCGCTC ATGAGACAAT AACCCTGATA
      CCCCCACATG TAAGTTTATA CATAGGCGAG TACTCTGTTA TTGGGACTAT

 51   AATGCTTCAA TAATATTGAA AAAGGAAGAG TATGAGTATT CAACATTTCC
      TTACGAAGTT ATTATAACTT TTTCCTTCTC ATACTCATAA GTTGTAAAGG

101   GTGTCGCCCT TATTCCCTTT TTTGCGGCAT TTTGCCTTCC TGTTTTTGCT
      CACAGCGGGA ATAAGGGAAA AAACGCCGTA AAACGGAAGG ACAAAAACGA

151   CACCCAGAAA CGCTGGTGAA AGTAAAAGAT GCTGAGGATC AGTTGGGTGC
      GTGGGTCTTT GCGACCACTT TCATTTTCTA CGACTCCTAG TCAACCCACG

201   GCGAGTGGGT TACATCGAAC TGGATCTCAA CAGCGGTAAG ATCCTTGAGA
      CGCTCACCCA ATGTAGCTTG ACCTAGAGTT GTCGCCATTC TAGGAACTCT

                       XmnI
                   ~~~~~~~~~~~~
251   GTTTTCGCCC CGAAGAACGT TTTCCAATGA TGAGCACTTT TAAAGTTCTG
      CAAAAGCGGG GCTTCTTGCA AAAGGTTACT ACTCGTGAAA ATTTCAAGAC
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
301  CTATGTGGCG CGGTATTATC CCGTATTGAC GCCGGGCAAG AGCAACTCGG
     GATACACCGC GCCATAATAG GGCATAACTG CGGCCCGTTC TCGTTGAGCC

351  TCGCCGCATA CACTATTCTC AGAATGACTT GGTTGAGTAC TCACCAGTCA
     AGCGGCGTAT GTGATAAGAG TCTTACTGAA CCAACTCATG AGTGGTCAGT

401  CAGAAAAGCA TCTTACGGAT GGCATGACAG TAAGAGAATT ATGCAGTGCT
     GTCTTTTCGT AGAATGCCTA CCGTACTGTC ATTCTCTTAA TACGTCACGA

451  GCCATAACCA TGAGTGATAA CACTGCGGCC AACTTACTTC TGACAACGAT
     CGGTATTGGT ACTCACTATT GTGACGCCGG TTGAATGAAG ACTGTTGCTA

501  CGGAGGACCG AAGGAGCTAA CCGCTTTTTT GCACAACATG GGGGATCATG
     GCCTCCTGGC TTCCTCGATT GGCGAAAAAA CGTGTTGTAC CCCCTAGTAC

551  TAACTCGCCT TGATCGTTGG GAACCGGAGC TGAATGAAGC CATACCAAAC
     ATTGAGCGGA ACTAGCAACC CTTGGCCTCG ACTTACTTCG GTATGGTTTG

601  GACGAGCGTG ACACCACGAT GCCTGTAGCA ATGGCAACAA CGTTGCGCAA
     CTGCTCGCAC TGTGGTGCTA CGGACATCGT TACCGTTGTT GCAACGCGTT

651  ACTATTAACT GGCGAACTAC TTACTCTAGC TTCCCGGCAA CAGTTAATAG
     TGATAATTGA CCGCTTGATG AATGAGATCG AAGGGCCGTT GTCAATTATC
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
701   ACTGGATGGA GGCGGATAAA GTTGCAGGAC CACTTCTGCG CTCGGCCCTT
      TGACCTACCT CCGCCTATTT CAACGTCCTG GTGAAGACGC GAGCCGGGAA

751   CCGGCTGGCT GGTTTATTGC TGATAAATCT GGAGCCGGTG AGCGTGGGTC
      GGCCGACCGA CCAAATAACG ACTATTTAGA CCTCGGCCAC TCGCACCCAG

801   TCGCGGTATC ATTGCAGCAC TGGGGCCAGA TGGTAAGCCC TCCCGTATCG
      AGCGCCATAG TAACGTCGTG ACCCCGGTCT ACCATTCGGG AGGGCATAGC

851   TAGTTATCTA CACGACGGGG AGTCAGGCAA CTATGGATGA ACGAAATAGA
      ATCAATAGAT GTGCTGCCCC TCAGTCCGTT GATACCTACT TGCTTTATCT

901   CAGATCGCTG AGATAGGTGC CTCACTGATT AAGCATTGGG TAACTGTCAG
      GTCTAGCGAC TCTATCCACG GAGTGACTAA TTCGTAACCC ATTGACAGTC

951   ACCAAGTTTA CTCATATATA CTTTAGATTG ATTTAAAACT TCATTTTTAA
      TGGTTCAAAT GAGTATATAT GAAATCTAAC TAAATTTTGA AGTAAAAATT

1001  TTTAAAAGGA TCTAGGTGAA GATCCTTTTT GATAATCTCA TGACCAAAAT
      AAATTTTCCT AGATCCACTT CTAGGAAAAA CTATTAGAGT ACTGGTTTTA

1051  CCCTTAACGT GAGTTTTCGT TCCACTGAGC GTCAGACCCC GTAGAAAAGA
      GGGAATTGCA CTCAAAAGCA AGGTGACTCG CAGTCTGGGG CATCTTTTCT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
                                                       FseI         PacI
                                                    ~~~~~~~~~~        ~~
1101   TCAAAGGATC TTCTTGAGAT CCTTTTTGAT AATGGCCGGC CCCCCCCCTT
       AGTTTCCTAG AAGAACTCTA GGAAAAACTA TTACCGGCCG GGGGGGGGAA

       PacI
       ~~~~~~~
1151   AATTAAGGGG GGG
       TTAATTCCCC CCC
```

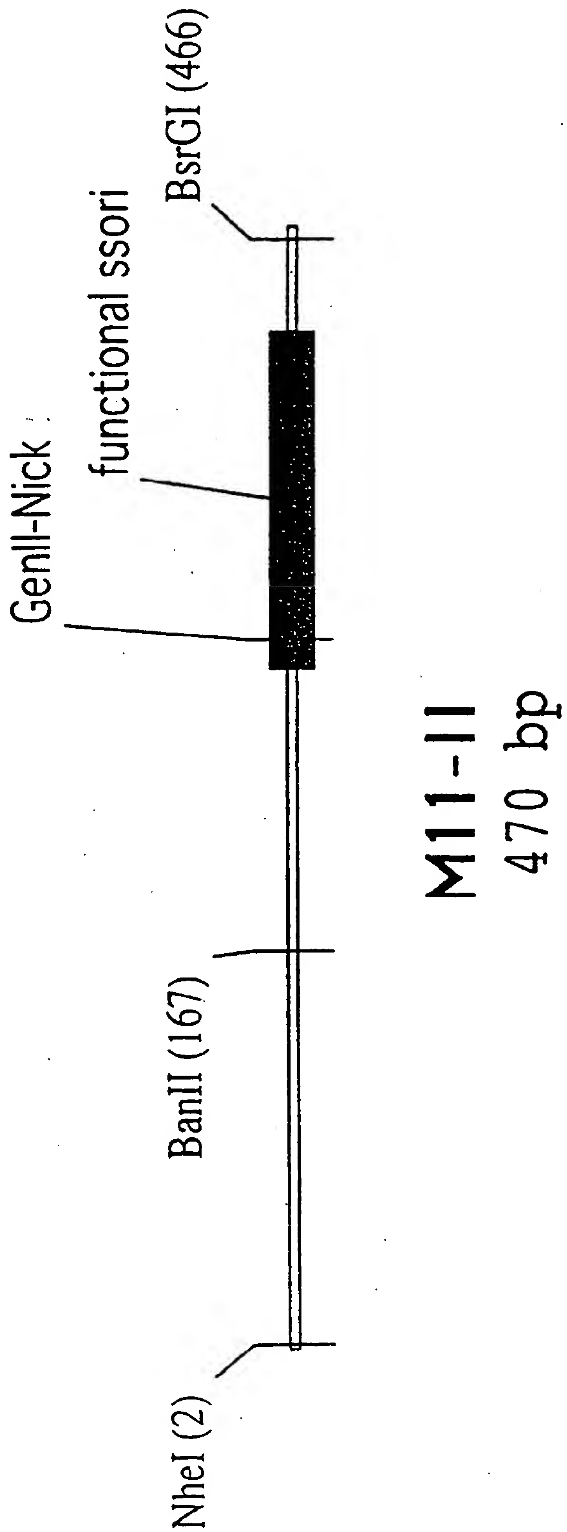


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
M11-II:

      NheI
      ~~~~~~
  1   GCTAGCACGC GCCCTGTAGC GGCGCATTAA GCGCGGCGGG TGTGGTGGTT
      CGATCGTGCG CGGGACATCG CCGCGTAATT CGCGCCGCCC ACACCACCAA

 51   ACGCGCAGCG TGACCGCTAC ACTTGCCAGC GCCCTAGCGC CCGCTCCTTT
      TGCGCGTCGC ACTGGCGATG TGAACGGTCG CGGGATCGCG GGCGAGGAAA

101   CGCTTTCTTC CCTTCCTTTC TCGCCACGTT CGCCGGCTTT CCCCGTCAAG
      GCGAAAGAAG GGAAGGAAAG AGCGGTGCAA GCGGCCGAAA GGGGCAGTTC

                 BanII
                 ~~~~~~
151   CTCTAAATCG GGGGCTCCCT TTAGGGTTCC GATTTAGTGC TTTACGGCAC
      GAGATTTAGC CCCCGAGGGA AATCCCAAGG CTAAATCACG AAATGCCGTG

201   CTCGACCCCA AAAAACTTGA TTAGGGTGAT GGTTCTCGTA GTGGGCCATC
      GAGCTGGGGT TTTTTGAACT AATCCCACTA CCAAGAGCAT CACCCGGTAG

251   GCCCTGATAG ACGGTTTTTC GCCCTTTGAC GTTGGAGTCC ACGTTCTTTA
      CGGGACTATC TGCCAAAAAG CGGGAAACTG CAACCTCAGG TGCAAGAAAT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
301   ATAGTGGACT CTTGTTCCAA ACTGGAACAA CACTCAACCC TATCTCGGTC
      TATCACCTGA GAACAAGGTT TGACCTTGTT GTGAGTTGGG ATAGAGCCAG

351   TATTCTTTTG ATTTATAAGG GATTTTGCCG ATTTCGGCCT ATTGGTTAAA
      ATAAGAAAAC TAAATATTCC CTAAAACGGC TAAAGCCGGA TAACCAATTT

401   AAATGAGCTG ATTTAACAAA AATTTAACGC GAATTTTAAC AAAATATTAA
      TTTACTCGAC TAAATTGTTT TTAAATTGCG CTTAAAATTG TTTTATAATT

                         BsrGI
                        ~~~~~~~
451   CGTTTACAAT TTCATGTACA
      GCAAATGTTA AAGTACATGT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

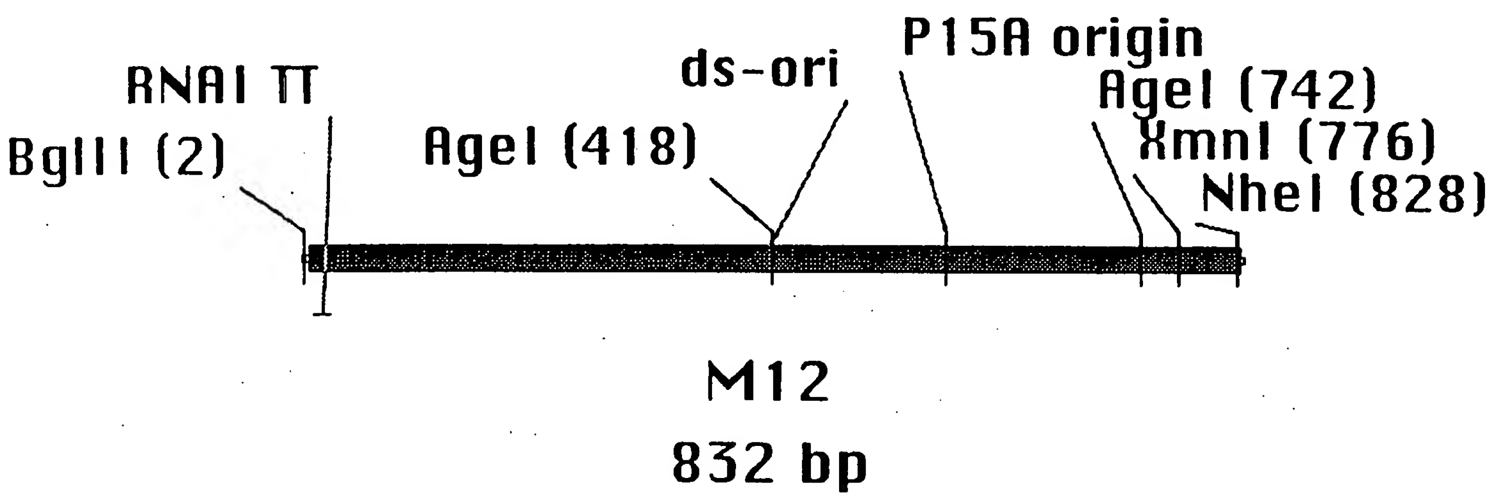


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 12:

```
           BglII
         ~~~~~~~
  1      AGATCTAATA AGATGATCTT CTTGAGATCG TTTTGGTCTG CGCGTAATCT
         TCTAGATTAT TCTACTAGAA GAACTCTAGC AAAACCAGAC GCGCATTAGA

 51      CTTGCTCTGA AAACGAAAAA ACCGCCTTGC AGGGCGGTTT TTCGTAGGTT
         GAACGAGACT TTTGCTTTTT TGGCGGAACG TCCCGCCAAA AAGCATCCAA

101      CTCTGAGCTA CCAACTCTTT GAACCGAGGT AACTGGCTTG GAGGAGCGCA
         GAGACTCGAT GGTTGAGAAA CTTGGCTCCA TTGACCGAAC CTCCTCGCGT

151      GTCACTAAAA CTTGTCCTTT CAGTTTAGCC TTAACCGGCG CATGACTTCA
         CAGTGATTTT GAACAGGAAA GTCAAATCGG AATTGGCCGC GTACTGAAGT

201      AGACTAACTC CTCTAAATCA ATTACCAGTG GCTGCTGCCA GTGGTGCTTT
         TCTGATTGAG GAGATTTAGT TAATGGTCAC CGACGACGGT CACCACGAAA

251      TGCATGTCTT TCCGGGTTGG ACTCAAGACG ATAGTTACCG GATAAGGCGC
         ACGTACAGAA AGGCCCAACC TGAGTTCTGC TATCAATGGC CTATTCCGCG

301      AGCGGTCGGA CTGAACGGGG GGTTCGTGCA TACAGTCCAG CTTGGAGCGA
         TCGCCAGCCT GACTTGCCCC CCAAGCACGT ATGTCAGGTC GAACCTCGCT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
351   ACTGCCTACC CGGAACTGAG TGTCAGGCGT GGAATGAGAC AAACGCGGCC
      TGACGGATGG GCCTTGACTC ACAGTCCGCA CCTTACTCTG TTTGCGCCGG

                           AgeI
                         ~~~~~~~~
401   ATAACAGCGG AATGACACCG GTAAACCGAA AGGCAGGAAC AGGAGAGCGC
      TATTGTCGCC TTACTGTGGC CATTTGGCTT TCCGTCCTTG TCCTCTCGCG

451   AGGAGGGAGC CGCCAGGGGG AAACGCCTGG TATCTTTATA GTCCTGTCGG
      TCCTCCCTCG GCGGTCCCCC TTTGCGGACC ATAGAAATAT CAGGACAGCC

501   GTTTCGCCAC CACTGATTTG AGCGTCAGAT TTCGTGATGC TTGTCAGGGG
      CAAAGCGGTG GTGACTAAAC TCGCAGTCTA AAGCACTACG AACAGTCCCC

551   GGCGGAGCCT ATGGAAAAAC GGCTTTGCCG CGGCCCTCTC ACTTCCCTGT
      CCGCCTCGGA TACCTTTTTG CCGAAACGGC GCCGGGAGAG TGAAGGGACA

601   TAAGTATCTT CCTGGCATCT TCCAGGAAAT CTCCGCCCCG TTCGTAAGCC
      ATTCATAGAA GGACCGTAGA AGGTCCTTTA GAGGCGGGGC AAGCATTCGG

651   ATTTCCGCTC GCCGCAGTCG AACGACCGAG CGTAGCGAGT CAGTGAGCGA
      TAAAGGCGAG CGGCGTCAGC TTGCTGGCTC GCATCGCTCA GTCACTCGCT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
                                                          AgeI
                                                          ~~~~~~~
701   GGAAGCGGAA TATATCCTGT ATCACATATT CTGCTGACGC ACCGGTGCAG
      CCTTCGCCTT ATATAGGACA TAGTGTATAA GACGACTGCG TGGCCACGTC

                            XmnI
                          ~~~~~~~~~~~
751   CCTTTTTTCT CCTGCCACAT GAAGCACTTC ACTGACACCC TCATCAGTGC
      GGAAAAAAGA GGACGGTGTA CTTCGTGAAG TGACTGTGGG AGTAGTCACG

                                  NheI
                                ~~~~~~~
801   CAACATAGTA AGCCAGTATA CACTCCGCTA GC
      GTTGTATCAT TCGGTCATAT GTGAGGCGAT CG
```

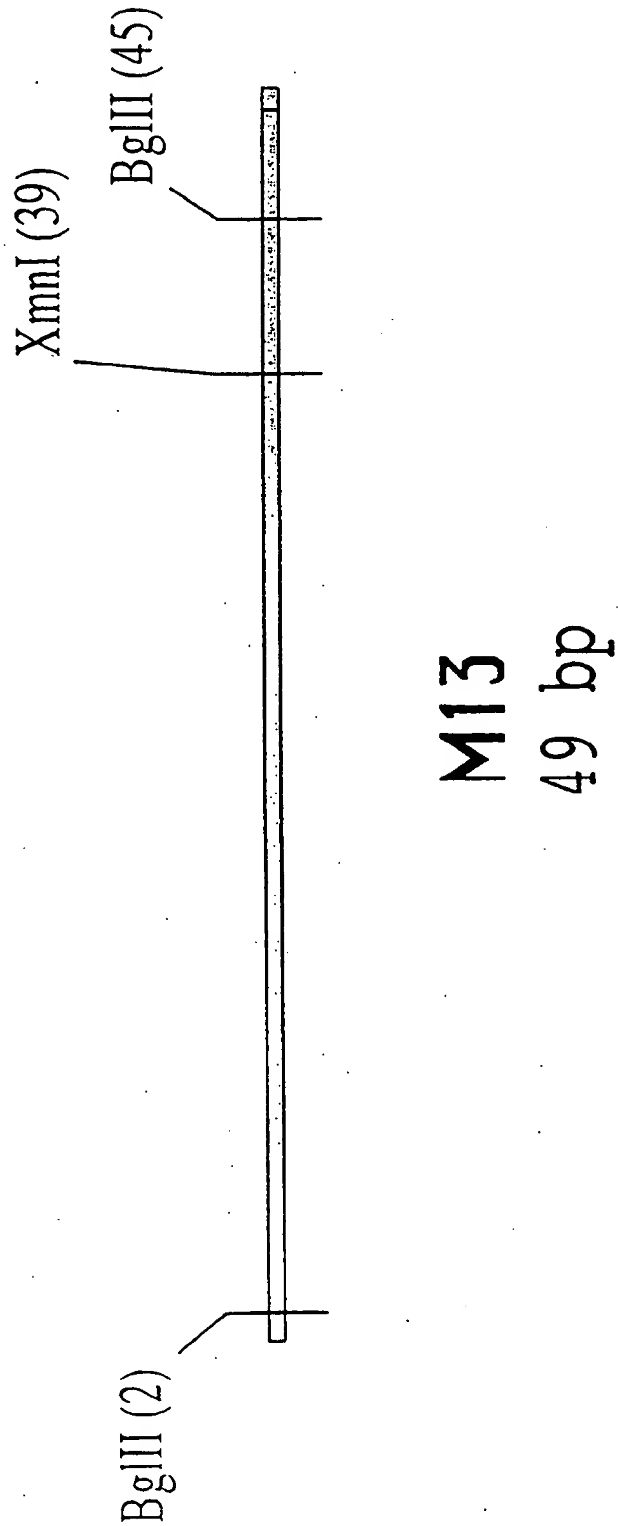


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 13:

```
    BglII                                      XmnI      BglII
    ~~~~~~                                 ~~~~~~~~~~~~~~~~~~~
1   AGATCTCATA ACTTCGTATA ATGTATGCTA TACGAAGTTA TTCAGATCT
    TCTAGAGTAT TGAAGCATAT TACATACGAT ATGCTTCAAT AAGTCTAGA
```

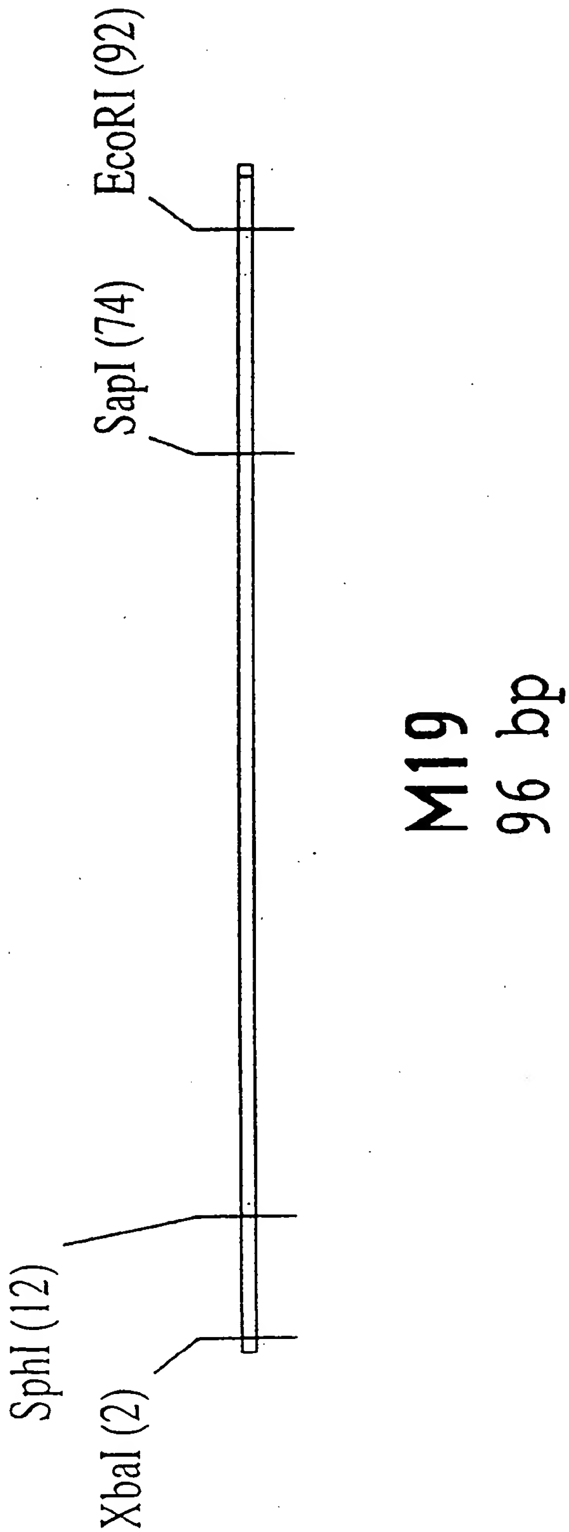


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 19:

```
      XbaI   SphI
     ~~~~~~~~~~~~~~~
1    TCTAGAGCAT GCGTAGGAGA AAATAAAATG AAACAAAGCA CTATTGCACT
     AGATCTCGTA CGCATCCTCT TTTATTTTAC TTTGTTTCGT GATAACGTGA

                     SapI                           EcoRI
                   ~~~~~~~~~                        ~~~~~~
51   GGCACTCTTA CCGTTGCTCT TCACCCCTGT TACCAAAGCC GAATTC
     CCGTGAGAAT GGCAACGAGA AGTGGGGACA ATGGTTTCGG CTTAAG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

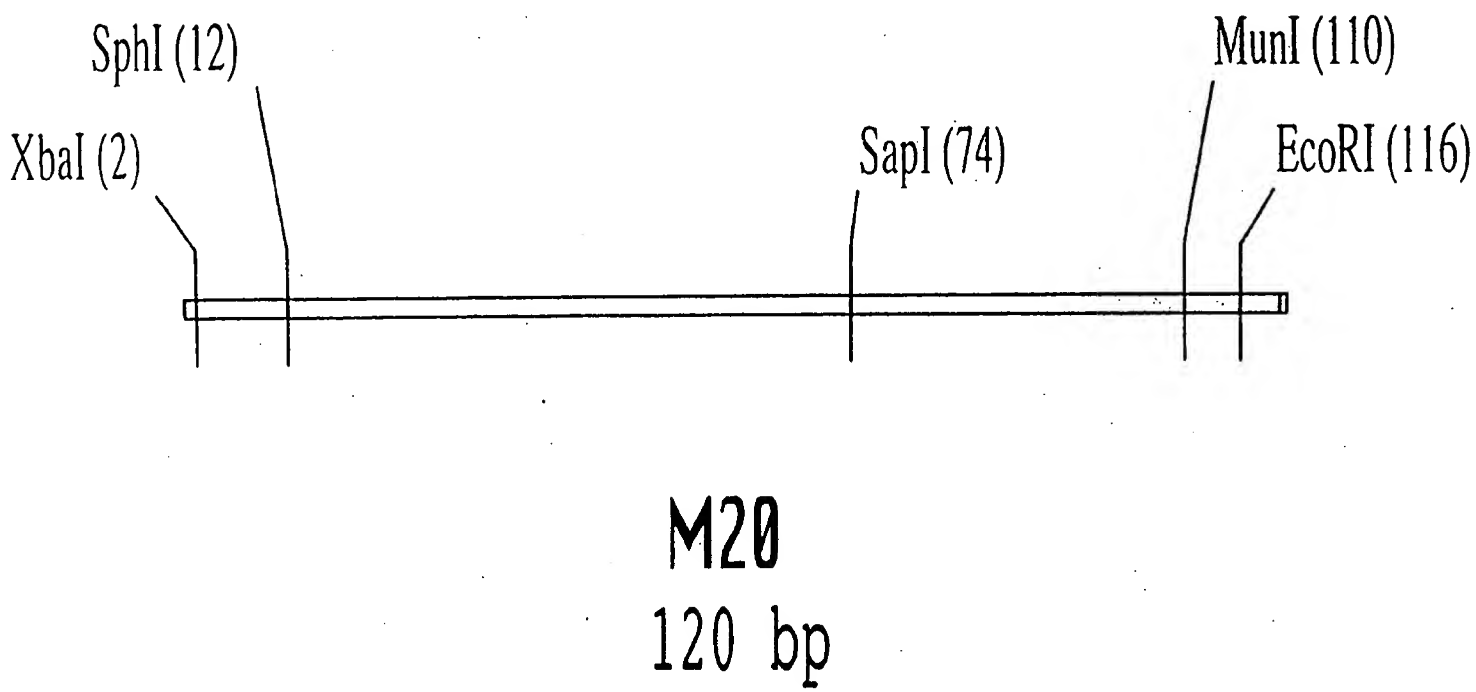


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 20:

```
      XbaI   SphI
     ~~~~~~~~~~~~~~
  1  TCTAGAGCAT GCGTAGGAGA AAATAAAATG AAACAAAGCA CTATTGCACT
     AGATCTCGTA CGCATCCTCT TTTATTTTAC TTTGTTTCGT GATAACGTGA

                      SapI
                    ~~~~~~~~~
 51  GGCACTCTTA CCGTTGCTCT TCACCCCTGT TACCAAAGCC GACTACAAAG
     CCGTGAGAAT GGCAACGAGA AGTGGGGACA ATGGTTTCGG CTGATGTTTC

               MunI    EcoRI
              ~~~~~~~~~~~~~~
101  ATGAAGTGCA ATTGGAATTC
     TACTTCACGT TAACCTTAAG
```

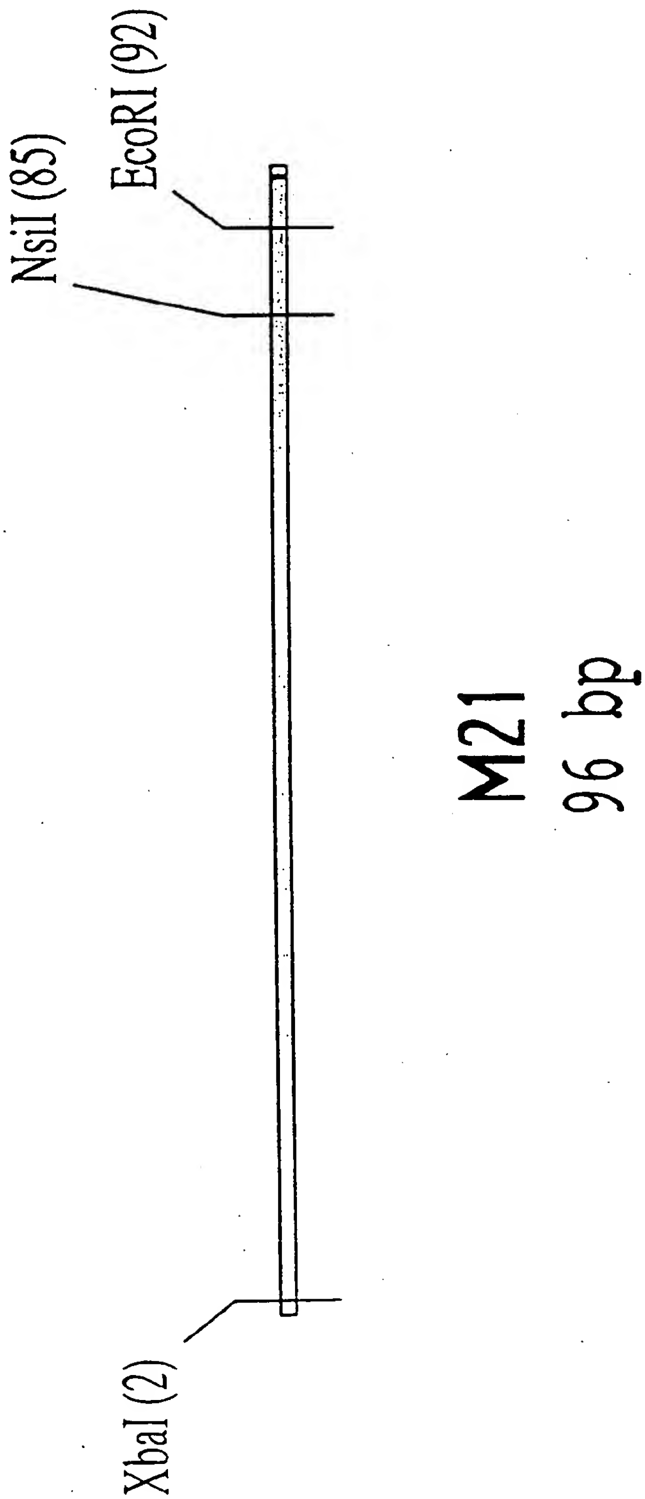


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 21:

```
      XbaI
     ~~~~~~~
  1  TCTAGAGGTT GAGGTGATTT TATGAAAAAG AATATCGCAT TTCTTCTTGC
     AGATCTCCAA CTCCACTAAA ATACTTTTTC TTATAGCGTA AAGAAGAACG

                                       NsiI       EcoRI
                                     ~~~~~~~~     ~~~~~~
 51  ATCTATGTTC GTTTTTTCTA TTGCTACAAA TGCATACGCT GAATTC
     TAGATACAAG CAAAAAAGAT AACGATGTTT ACGTATGCGA CTTAAG
```

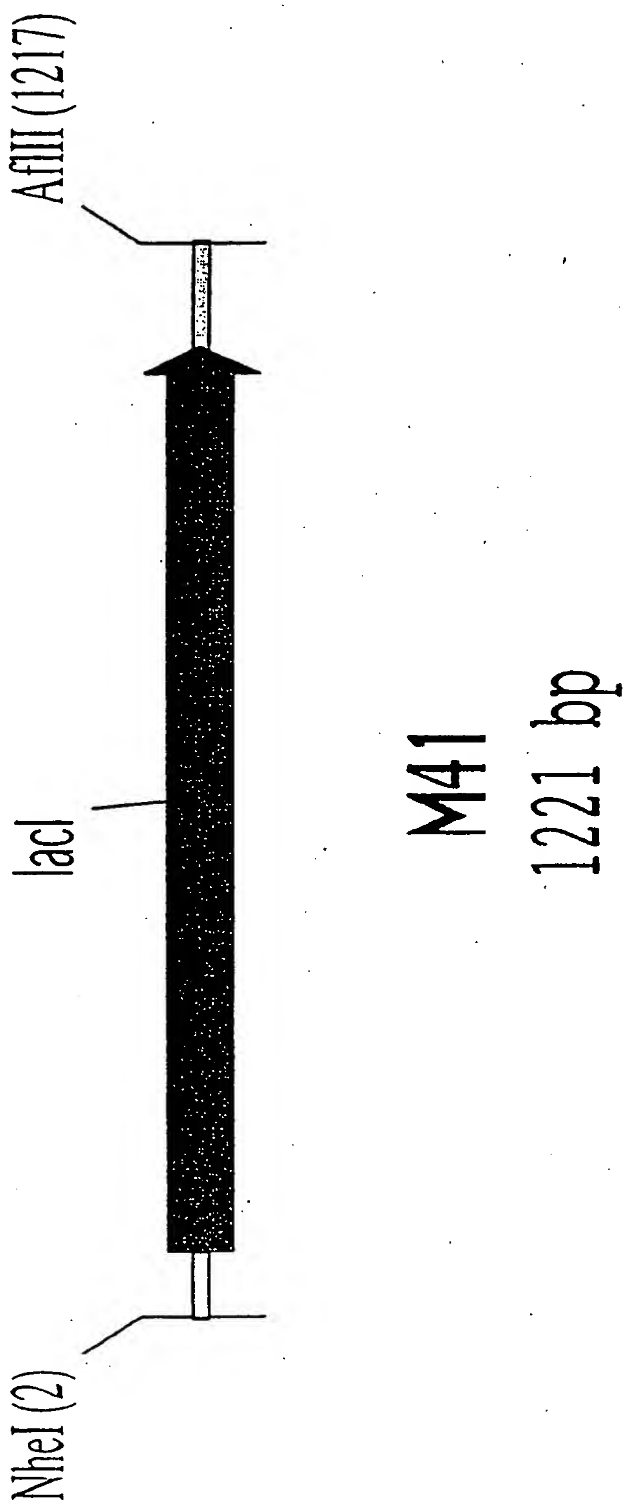


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

M 41:

```
         NheI
         ~~~~~~~
  1      GCTAGCATCG AATGGCGCAA AACCTTTCGC GGTATGGCAT GATAGCGCCC
         CGATCGTAGC TTACCGCGTT TTGGAAAGCG CCATACCGTA CTATCGCGGG

 51      GGAAGAGAGT CAATTCAGGG TGGTGAATGT GAAACCAGTA ACGTTATACG
         CCTTCTCTCA GTTAAGTCCC ACCACTTACA CTTTGGTCAT TGCAATATGC

101      ATGTCGCAGA GTATGCCGGT GTCTCTTATC AGACCGTTTC CCGCGTGGTG
         TACAGCGTCT CATACGGCCA CAGAGAATAG TCTGGCAAAG GGCGCACCAC

151      AACCAGGCCA GCCACGTTTC TGCGAAAACG CGGGAAAAAG TGGAAGCGGC
         TTGGTCCGGT CGGTGCAAAG ACGCTTTTGC GCCCTTTTTC ACCTTCGCCG

201      GATGGCGGAG CTGAATTACA TTCCTAACCG CGTGGCACAA CAACTGGCGG
         CTACCGCCTC GACTTAATGT AAGGATTGGC GCACCGTGTT GTTGACCGCC

251      GCAAACAGTC GTTGCTGATT GGCGTTGCCA CCTCCAGTCT GGCCCTGCAC
         CGTTTGTCAG CAACGACTAA CCGCAACGGT GGAGGTCAGA CCGGGACGTG

301      GCGCCGTCGC AAATTGTCGC GGCGATTAAA TCTCGCGCCG ATCAACTGGG
         CGCGGCAGCG TTTAACAGCG CCGCTAATTT AGAGCGCGGC TAGTTGACCC
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
351  TGCCAGCGTG GTCGTGTCGA TGGTAGAACG AAGCGGCGTC GAAGCCTGTA
     ACGGTCGCAC CAGCACAGCT ACCATCTTGC TTCGCCGCAG CTTCGGACAT

401  AAGCGGCGGT GCACAATCTT CTCGCGCAAC GTGTCAGTGG GCTGATTATT
     TTCGCCGCCA CGTGTTAGAA GAGCGCGTTG CACAGTCACC CGACTAATAA

451  AACTATCCGC TGGATGACCA GGATGCTATT GCTGTGGAAG CTGCCTGCAC
     TTGATAGGCG ACCTACTGGT CCTACGATAA CGACACCTTC GACGGACGTG

501  TAATGTTCCG GCGTTATTTC TTGATGTCTC TGACCAGACA CCCATCAACA
     ATTACAAGGC CGCAATAAAG AACTACAGAG ACTGGTCTGT GGGTAGTTGT

551  GTATTATTTT CTCCCATGAG GACGGTACGC GACTGGGCGT GGAGCATCTG
     CATAATAAAA GAGGGTACTC CTGCCATGCG CTGACCCGCA CCTCGTAGAC

601  GTCGCATTGG GCCACCAGCA AATCGCGCTG TTAGCTGGCC CATTAAGTTC
     CAGCGTAACC CGGTGGTCGT TTAGCGCGAC AATCGACCGG GTAATTCAAG

651  TGTCTCGGCG CGTCTGCGTC TGGCTGGCTG GCATAAATAT CTCACTCGCA
     ACAGAGCCGC GCAGACGCAG ACCGACCGAC CGTATTTATA GAGTGAGCGT

701  ATCAAATTCA GCCGATAGCG GAACGGGAAG GCGACTGGAG TGCCATGTCC
     TAGTTTAAGT CGGCTATCGC CTTGCCCTTC CGCTGACCTC ACGGTACAGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
751   GGTTTTCAAC AAACCATGCA AATGCTGAAT GAGGGCATCG TTCCCACTGC
      CCAAAAGTTG TTTGGTACGT TTACGACTTA CTCCCGTAGC AAGGGTGACG

801   GATGCTGGTT GCCAACGATC AGATGGCGCT GGGCGCAATG CGTGCCATTA
      CTACGACCAA CGGTTGCTAG TCTACCGCGA CCCGCGTTAC GCACGGTAAT

851   CCGAGTCCGG GCTGCGCGTT GGTGCGGACA TCTCGGTAGT GGGATACGAC
      GGCTCAGGCC CGACGCGCAA CCACGCCTGT AGAGCCATCA CCCTATGCTG

901   GATACCGAGG ACAGCTCATG TTATATCCCG CCGCTGACCA CCATCAAACA
      CTATGGCTCC TGTCGAGTAC AATATAGGGC GGCGACTGGT GGTAGTTTGT

951   GGATTTTCGC CTGCTGGGGC AAACCAGCGT GGACCGCTTG CTGCAACTCT
      CCTAAAAGCG GACGACCCCG TTTGGTCGCA CCTGGCGAAC GACGTTGAGA

1001  CTCAGGGCCA GGCGGTGAAG GGCAATCAGC TGTTGCCCGT CTCACTGGTG
      GAGTCCCGGT CCGCCACTTC CCGTTAGTCG ACAACGGGCA GAGTGACCAC

1051  AAAAGAAAAA CCACCCTGGC TCCCAATACG CAAACCGCCT CTCCCCGCGC
      TTTTCTTTTT GGTGGGACCG AGGGTTATGC GTTTGGCGGA GAGGGGCGCG

1101  GTTGGCCGAT TCACTGATGC AGCTGGCACG ACAGGTTTCC CGACTGGAAA
      CAACCGGCTA AGTGACTACG TCGACCGTGC TGTCCAAAGG GCTGACCTTT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1151   GCGGGCAGTG AGGCTACCCG ATAAAAGCGG CTTCCTGACA GGAGGCCGTT
       CGCCCGTCAC TCCGATGGGC TATTTTCGCC GAAGGACTGT CCTCCGGCAA

                             AflII
                            ~~~~~~~
1201   TTGTTTTGCA GCCCACTTAA G
       AACAAAACGT CGGGTGAATT C
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

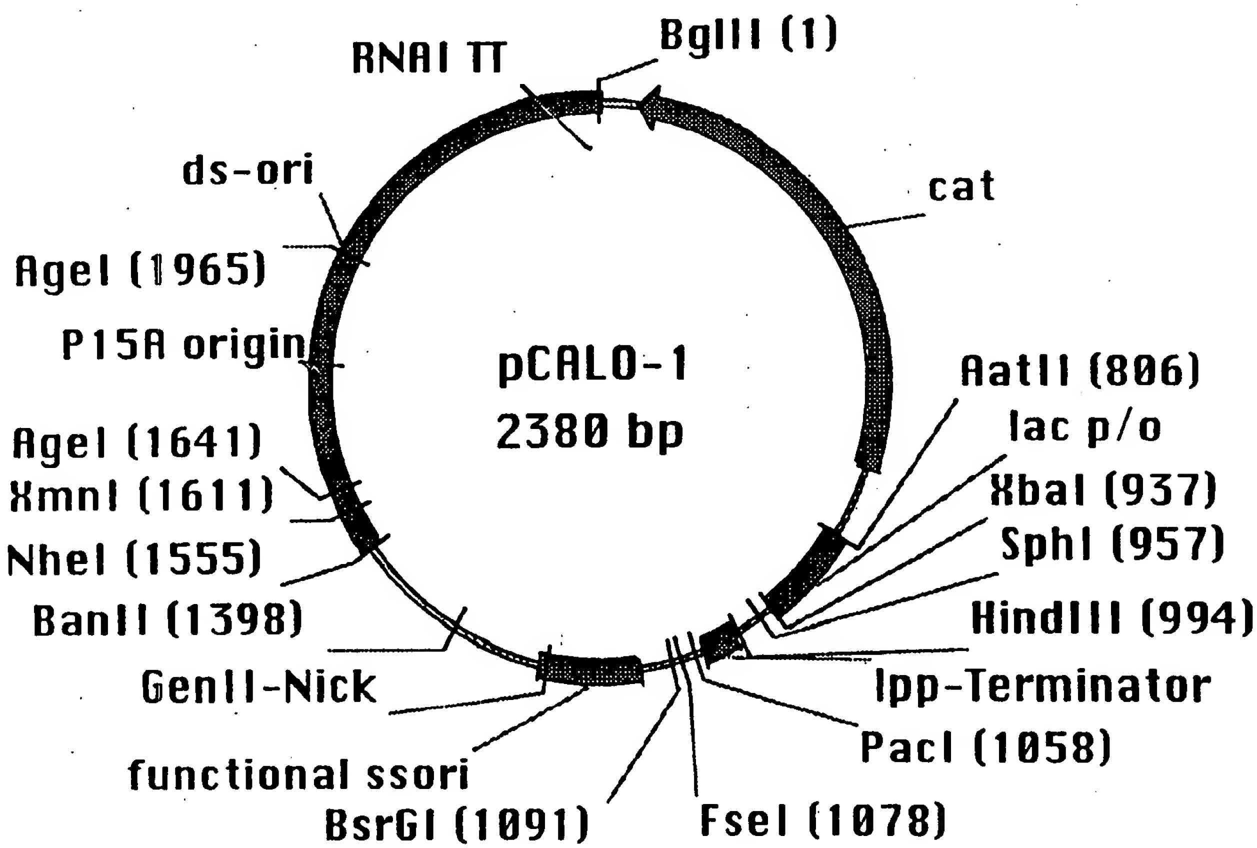


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

pCAL0-1:

```
       BglII
       ~~~~~
  1    GATCTAGCAC CAGGCGTTTA AGGGCACCAA TAACTGCCTT AAAAAAATTA
       CTAGATCGTG GTCCGCAAAT TCCCGTGGTT ATTGACGGAA TTTTTTTAAT

 51    CGCCCCGCCC TGCCACTCAT CGCAGTACTG TTGTAATTCA TTAAGCATTC
       GCGGGGCGGG ACGGTGAGTA GCGTCATGAC AACATTAAGT AATTCGTAAG

101    TGCCGACATG GAAGCCATCA CAAACGGCAT GATGAACCTG AATCGCCAGC
       ACGGCTGTAC CTTCGGTAGT GTTTGCCGTA CTACTTGGAC TTAGCGGTCG

151    GGCATCAGCA CCTTGTCGCC TTGCGTATAA TATTTGCCCA TAGTGAAAAC
       CCGTAGTCGT GGAACAGCGG AACGCATATT ATAAACGGGT ATCACTTTTG

201    GGGGGCGAAG AAGTTGTCCA TATTGGCTAC GTTTAAATCA AAACTGGTGA
       CCCCCGCTTC TTCAACAGGT ATAACCGATG CAAATTTAGT TTTGACCACT

251    AACTCACCCA GGGATTGGCT GAGACGAAAA ACATATTCTC AATAAACCCT
       TTGAGTGGGT CCCTAACCGA CTCTGCTTTT TGTATAAGAG TTATTTGGGA

301    TTAGGGAAAT AGGCCAGGTT TTCACCGTAA CACGCCACAT CTTGCGAATA
       AATCCCTTTA TCCGGTCCAA AAGTGGCATT GTGCGGTGTA GAACGCTTAT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
351  TATGTGTAGA AACTGCCGGA AATCGTCGTG GTATTCACTC CAGAGCGATG
     ATACACATCT TTGACGGCCT TTAGCAGCAC CATAAGTGAG GTCTCGCTAC

401  AAAACGTTTC AGTTTGCTCA TGGAAAACGG TGTAACAAGG GTGAACACTA
     TTTTGCAAAG TCAAACGAGT ACCTTTTGCC ACATTGTTCC CACTTGTGAT

451  TCCCATATCA CCAGCTCACC GTCTTTCATT GCCATACGGA ACTCCGGGTG
     AGGGTATAGT GGTCGAGTGG CAGAAAGTAA CGGTATGCCT TGAGGCCCAC

501  AGCATTCATC AGGCGGGCAA GAATGTGAAT AAAGGCCGGA TAAAACTTGT
     TCGTAAGTAG TCCGCCCGTT CTTACACTTA TTTCCGGCCT ATTTTGAACA

551  GCTTATTTTT CTTTACGGTC TTTAAAAAGG CCGTAATATC CAGCTGAACG
     CGAATAAAAA GAAATGCCAG AAATTTTTCC GGCATTATAG GTCGACTTGC

601  GTCTGGTTAT AGGTACATTG AGCAACTGAC TGAAATGCCT CAAAATGTTC
     CAGACCAATA TCCATGTAAC TCGTTGACTG ACTTTACGGA GTTTTACAAG

651  TTTACGATGC CATTGGGATA TATCAACGGT GGTATATCCA GTGATTTTTT
     AAATGCTACG GTAACCCTAT ATAGTTGCCA CCATATAGGT CACTAAAAAA

701  TCTCCATTTT AGCTTCCTTA GCTCCTGAAA ATCTCGATAA CTCAAAAAAT
     AGAGGTAAAA TCGAAGGAAT CGAGGACTTT TAGAGCTATT GAGTTTTTTA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
 751  ACGCCCGGTA GTGATCTTAT TTCATTATGG TGAAAGTTGG AACCTCACCC
      TGCGGGCCAT CACTAGAATA AAGTAATACC ACTTTCAACC TTGGAGTGGG

       AatII
      ~~~~~~~
 801  GACGTCTAAT GTGAGTTAGC TCACTCATTA GGCACCCCAG GCTTTACACT
      CTGCAGATTA CACTCAATCG AGTGAGTAAT CCGTGGGGTC CGAAATGTGA

 851  TTATGCTTCC GGCTCGTATG TTGTGTGGAA TTGTGAGCGG ATAACAATTT
      AATACGAAGG CCGAGCATAC AACACACCTT AACACTCGCC TATTGTTAAA

                                           XbaI
                                         ~~~~~~~~
 901  CACACAGGAA ACAGCTATGA CCATGATTAC GAATTTCTAG ACCCCCCCCC
      GTGTGTCCTT TGTCGATACT GGTACTAATG CTTAAAGATC TGGGGGGGGG

        SphI                                          HindIII
       ~~~~~~~                                       ~~~~~~~
 951  CGCATGCCAT AACTTCGTAT AATGTACGCT ATACGAAGTT ATAAGCTTGA
      GCGTACGGTA TTGAAGCATA TTACATGCGA TATGCTTCAA TATTCGAACT

1001  CCTGTGAAGT GAAAAATGGC GCAGATTGTG CGACATTTTT TTTGTCTGCC
      GGACACTTCA CTTTTTACCG CGTCTAACAC GCTGTAAAAA AAACAGACGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
                PacI                       FseI                    BsrGI
              ~~~~~~~~~                  ~~~~~~~~~               ~~~~~~~~
1051   GTTTAATTAA AGGGGGGGGG GGGCCGGCCT GGGGGGGGGT GTACATGAAA
       CAAATTAATT TCCCCCCCCC CCCGGCCGGA CCCCCCCCCA CATGTACTTT

1101   TTGTAAACGT TAATATTTTG TTAAAATTCG CGTTAAATTT TTGTTAAATC
       AACATTTGCA ATTATAAAAC AATTTTAAGC GCAATTTAAA AACAATTTAG

1151   AGCTCATTTT TTAACCAATA GGCCGAAATC GGCAAAATCC CTTATAAATC
       TCGAGTAAAA AATTGGTTAT CCGGCTTTAG CCGTTTTAGG GAATATTTAG

1201   AAAAGAATAG ACCGAGATAG GGTTGAGTGT TGTTCCAGTT TGGAACAAGA
       TTTTCTTATC TGGCTCTATC CCAACTCACA ACAAGGTCAA ACCTTGTTCT

1251   GTCCACTATT AAAGAACGTG GACTCCAACG TCAAAGGGCG AAAAACCGTC
       CAGGTGATAA TTTCTTGCAC CTGAGGTTGC AGTTTCCCGC TTTTTGGCAG

1301   TATCAGGGCG ATGGCCCACT ACGAGAACCA TCACCCTAAT CAAGTTTTTT
       ATAGTCCCGC TACCGGGTGA TGCTCTTGGT AGTGGGATTA GTTCAAAAAA

                                                          BanII
                                                         ~~~~~~~
1351   GGGGTCGAGG TGCCGTAAAG CACTAAATCG GAACCCTAAA GGGAGCCCCC
       CCCCAGCTCC ACGGCATTTC GTGATTTAGC CTTGGGATTT CCCTCGGGGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
       GATGCGAGCC AGCAAGCTGA CGCCGCTCGC CTTTACCGAA TGCTTGCCCC

1751   CGGAGATTTC CTGGAAGATG CCAGGAAGAT ACTTAACAGG GAAGTGAGAG
       GCCTCTAAAG GACCTTCTAC GGTCCTTCTA TGAATTGTCC CTTCACTCTC

1801   GGCCGCGGCA AAGCCGTTTT TCCATAGGCT CCGCCCCCCT GACAAGCATC
       CCGGCGCCGT TTCGGCAAAA AGGTATCCGA GGCGGGGGGA CTGTTCGTAG

1851   ACGAAATCTG ACGCTCAAAT CAGTGGTGGC GAAACCCGAC AGGACTATAA
       TGCTTTAGAC TGCGAGTTTA GTCACCACCG CTTTGGGCTG TCCTGATATT

1901   AGATACCAGG CGTTTCCCCC TGGCGGCTCC CTCCTGCGCT CTCCTGTTCC
       TCTATGGTCC GCAAAGGGGG ACCGCCGAGG GAGGACGCGA GAGGACAAGG

                   AgeI
                  ~~~~~~
1951   TGCCTTTCGG TTTACCGGTG TCATTCCGCT GTTATGGCCG CGTTTGTCTC
       ACGGAAAGCC AAATGGCCAC AGTAAGGCGA CAATACCGGC GCAAACAGAG

2001   ATTCCACGCC TGACACTCAG TTCCGGGTAG GCAGTTCGCT CCAAGCTGGA
       TAAGGTGCGG ACTGTGAGTC AAGGCCCATC CGTCAAGCGA GGTTCGACCT

2051   CTGTATGCAC GAACCCCCCG TTCAGTCCGA CCGCTGCGCC TTATCCGGTA
       GACATACGTG CTTGGGGGGC AAGTCAGGCT GGCGACGCGG AATAGGCCAT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1401   GATTTAGAGC TTGACGGGGA AAGCCGGCGA ACGTGGCGAG AAAGGAAGGG
       CTAAATCTCG AACTGCCCCT TTCGGCCGCT TGCACCGCTC TTTCCTTCCC

1451   AAGAAAGCGA AAGGAGCGGG CGCTAGGGCG CTGGCAAGTG TAGCGGTCAC
       TTCTTTCGCT TTCCTCGCCC GCGATCCCGC GACCGTTCAC ATCGCCAGTG

1501   GCTGCGCGTA ACCACCACAC CCGCCGCGCT TAATGCGCCG CTACAGGGCG
       CGACGCGCAT TGGTGGTGTG GGCGGCGCGA ATTACGCGGC GATGTCCCGC

          NheI
         ~~~~~~~
1551   CGTGCTAGCG GAGTGTATAC TGGCTTACTA TGTTGGCACT GATGAGGGTG
       GCACGATCGC CTCACATATG ACCGAATGAT ACAACCGTGA CTACTCCCAC

              XmnI                                AgeI
          ~~~~~~~~~~~~                          ~~~~~~~~
1601   TCAGTGAAGT GCTTCATGTG GCAGGAGAAA AAAGGCTGCA CCGGTGCGTC
       AGTCACTTCA CGAAGTACAC CGTCCTCTTT TTTCCGACGT GGCCACGCAG

1651   AGCAGAATAT GTGATACAGG ATATATTCCG CTTCCTCGCT CACTGACTCG
       TCGTCTTATA CACTATGTCC TATATAAGGC GAAGGAGCGA GTGACTGAGC

1701   CTACGCTCGG TCGTTCGACT GCGGCGAGCG GAAATGGCTT ACGAACGGGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2101   ACTATCGTCT TGAGTCCAAC CCGGAAAGAC ATGCAAAAGC ACCACTGGCA
       TGATAGCAGA ACTCAGGTTG GGCCTTTCTG TACGTTTTCG TGGTGACCGT

2151   GCAGCCACTG GTAATTGATT TAGAGGAGTT AGTCTTGAAG TCATGCGCCG
       CGTCGGTGAC CATTAACTAA ATCTCCTCAA TCAGAACTTC AGTACGCGGC

2201   GTTAAGGCTA AACTGAAAGG ACAAGTTTTA GTGACTGCGC TCCTCCAAGC
       CAATTCCGAT TTGACTTTCC TGTTCAAAAT CACTGACGCG AGGAGGTTCG

2251   CAGTTACCTC GGTTCAAAGA GTTGGTAGCT CAGAGAACCT ACGAAAAACC
       GTCAATGGAG CCAAGTTTCT CAACCATCGA GTCTCTTGGA TGCTTTTTGG

2301   GCCCTGCAAG GCGGTTTTTT CGTTTTCAGA GCAAGAGATT ACGCGCAGAC
       CGGGACGTTC CGCCAAAAAA GCAAAAGTCT CGTTCTCTAA TGCGCGTCTG

                                 BglII
                                     ~
2351   CAAAACGATC TCAAGAAGAT CATCTTATTA
       GTTTTGCTAG AGTTCTTCTA GTAGAATAAT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

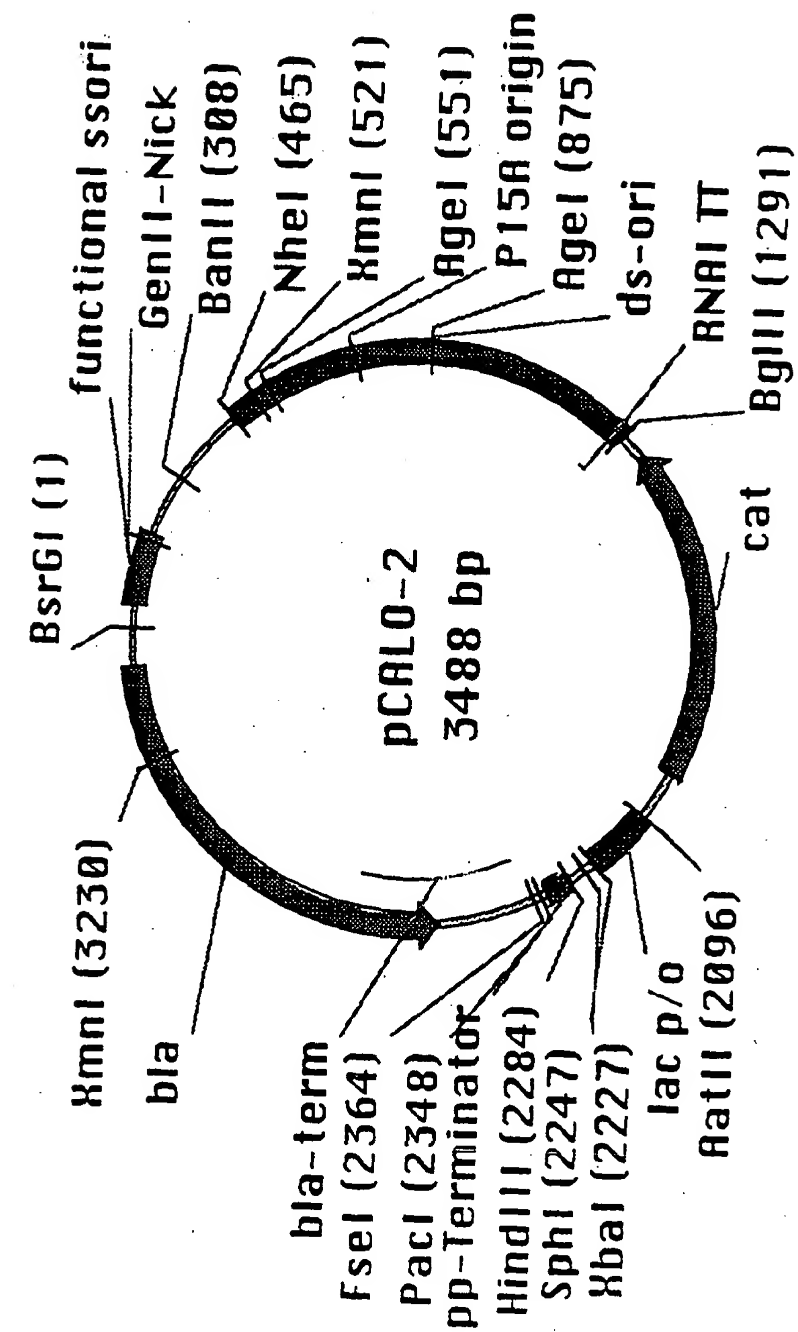


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

pCALO-2:

```
       BsrGI
       ~~~~~~
  1    GTACATGAAA TTGTAAACGT TAATATTTTG TTAAAATTCG CGTTAAATTT
       CATGTACTTT AACATTTGCA ATTATAAAAC AATTTTAAGC GCAATTTAAA

 51    TTGTTAAATC AGCTCATTTT TTAACCAATA GGCCGAAATC GGCAAAATCC
       AACAATTTAG TCGAGTAAAA AATTGGTTAT CCGGCTTTAG CCGTTTTAGG

101    CTTATAAATC AAAAGAATAG ACCGAGATAG GGTTGAGTGT TGTTCCAGTT
       GAATATTTAG TTTTCTTATC TGGCTCTATC CCAACTCACA ACAAGGTCAA

151    TGGAACAAGA GTCCACTATT AAAGAACGTG GACTCCAACG TCAAAGGGCG
       ACCTTGTTCT CAGGTGATAA TTTCTTGCAC CTGAGGTTGC AGTTTCCCGC

201    AAAAACCGTC TATCAGGGCG ATGGCCCACT ACGAGAACCA TCACCCTAAT
       TTTTTGGCAG ATAGTCCCGC TACCGGGTGA TGCTCTTGGT AGTGGGATTA

251    CAAGTTTTTT GGGGTCGAGG TGCCGTAAAG CACTAAATCG GAACCCTAAA
       GTTCAAAAAA CCCCAGCTCC ACGGCATTTC GTGATTTAGC CTTGGGATTT

          BanII
          ~~~~~~~
301    GGGAGCCCCC GATTTAGAGC TTGACGGGGA AAGCCGGCGA ACGTGGCGAG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
     CCCTCGGGGG CTAAATCTCG AACTGCCCCT TTCGGCCGCT TGCACCGCTC

351  AAAGGAAGGG AAGAAAGCGA AAGGAGCGGG CGCTAGGGCG CTGGCAAGTG
     TTTCCTTCCC TTCTTTCGCT TTCCTCGCCC GCGATCCCGC GACCGTTCAC

401  TAGCGGTCAC GCTGCGCGTA ACCACCACAC CCGCCGCGCT TAATGCGCCG
     ATCGCCAGTG CGACGCGCAT TGGTGGTGTG GGCGGCGCGA ATTACGCGGC

                 NheI
                ~~~~~~~
451  CTACAGGGCG CGTGCTAGCG GAGTGTATAC TGGCTTACTA TGTTGGCACT
     GATGTCCCGC GCACGATCGC CTCACATATG ACCGAATGAT ACAACCGTGA

                     XmnI                            AgeI
                  ~~~~~~~~~~~~                          ~
501  GATGAGGGTG TCAGTGAAGT GCTTCATGTG GCAGGAGAAA AAAGGCTGCA
     CTACTCCCAC AGTCACTTCA CGAAGTACAC CGTCCTCTTT TTTCCGACGT

     AgeI
     ~~~~~~
551  CCGGTGCGTC AGCAGAATAT GTGATACAGG ATATATTCCG CTTCCTCGCT
     GGCCACGCAG TCGTCTTATA CACTATGTCC TATATAAGGC GAAGGAGCGA

601  CACTGACTCG CTACGCTCGG TCGTTCGACT GCGGCGAGCG GAAATGGCTT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
       GTGACTGAGC GATGCGAGCC AGCAAGCTGA CGCCGCTCGC CTTTACCGAA

651    ACGAACGGGG CGGAGATTTC CTGGAAGATG CCAGGAAGAT ACTTAACAGG
       TGCTTGCCCC GCCTCTAAAG GACCTTCTAC GGTCCTTCTA TGAATTGTCC

701    GAAGTGAGAG GGCCGCGGCA AAGCCGTTTT TCCATAGGCT CCGCCCCCCT
       CTTCACTCTC CCGGCGCCGT TTCGGCAAAA AGGTATCCGA GGCGGGGGGA

751    GACAAGCATC ACGAAATCTG ACGCTCAAAT CAGTGGTGGC GAAACCCGAC
       CTGTTCGTAG TGCTTTAGAC TGCGAGTTTA GTCACCACCG CTTTGGGCTG

801    AGGACTATAA AGATACCAGG CGTTTCCCCC TGGCGGCTCC CTCCTGCGCT
       TCCTGATATT TCTATGGTCC GCAAAGGGGG ACCGCCGAGG GAGGACGCGA

                                  AgeI
                                 ~~~~~~
851    CTCCTGTTCC TGCCTTTCGG TTTACCGGTG TCATTCCGCT GTTATGGCCG
       GAGGACAAGG ACGGAAAGCC AAATGGCCAC AGTAAGGCGA CAATACCGGC

901    CGTTTGTCTC ATTCCACGCC TGACACTCAG TTCCGGGTAG GCAGTTCGCT
       GCAAACAGAG TAAGGTGCGG ACTGTGAGTC AAGGCCCATC CGTCAAGCGA

951    CCAAGCTGGA CTGTATGCAC GAACCCCCCG TTCAGTCCGA CCGCTGCGCC
       GGTTCGACCT GACATACGTG CTTGGGGGGC AAGTCAGGCT GGCGACGCGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1001   TTATCCGGTA ACTATCGTCT TGAGTCCAAC CCGGAAAGAC ATGCAAAAGC
       AATAGGCCAT TGATAGCAGA ACTCAGGTTG GGCCTTTCTG TACGTTTTCG

1051   ACCACTGGCA GCAGCCACTG GTAATTGATT TAGAGGAGTT AGTCTTGAAG
       TGGTGACCGT CGTCGGTGAC CATTAACTAA ATCTCCTCAA TCAGAACTTC

1101   TCATGCGCCG GTTAAGGCTA AACTGAAAGG ACAAGTTTTA GTGACTGCGC
       AGTACGCGGC CAATTCCGAT TTGACTTTCC TGTTCAAAAT CACTGACGCG

1151   TCCTCCAAGC CAGTTACCTC GGTTCAAAGA GTTGGTAGCT CAGAGAACCT
       AGGAGGTTCG GTCAATGGAG CCAAGTTTCT CAACCATCGA GTCTCTTGGA

1201   ACGAAAAACC GCCCTGCAAG GCGGTTTTTT CGTTTTCAGA GCAAGAGATT
       TGCTTTTTGG CGGGACGTTC CGCCAAAAAA GCAAAAGTCT CGTTCTCTAA

                                                 BglII
                                               ~~~~~~~~
1251   ACGCGCAGAC CAAAACGATC TCAAGAAGAT CATCTTATTA GATCTAGCAC
       TGCGCGTCTG GTTTTGCTAG AGTTCTTCTA GTAGAATAAT CTAGATCGTG

1301   CAGGCGTTTA AGGGCACCAA TAACTGCCTT AAAAAAATTA CGCCCCGCCC
       GTCCGCAAAT TCCCGTGGTT ATTGACGGAA TTTTTTTAAT GCGGGGCGGG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1351  TGCCACTCAT CGCAGTACTG TTGTAATTCA TTAAGCATTC TGCCGACATG
      ACGGTGAGTA GCGTCATGAC AACATTAAGT AATTCGTAAG ACGGCTGTAC

1401  GAAGCCATCA CAAACGGCAT GATGAACCTG AATCGCCAGC GGCATCAGCA
      CTTCGGTAGT GTTTGCCGTA CTACTTGGAC TTAGCGGTCG CCGTAGTCGT

1451  CCTTGTCGCC TTGCGTATAA TATTTGCCCA TAGTGAAAAC GGGGGCGAAG
      GGAACAGCGG AACGCATATT ATAAACGGGT ATCACTTTTG CCCCCGCTTC

1501  AAGTTGTCCA TATTGGCTAC GTTTAAATCA AAACTGGTGA AACTCACCCA
      TTCAACAGGT ATAACCGATG CAAATTTAGT TTTGACCACT TTGAGTGGGT

1551  GGGATTGGCT GAGACGAAAA ACATATTCTC AATAAACCCT TTAGGGAAAT
      CCCTAACCGA CTCTGCTTTT TGTATAAGAG TTATTTGGGA AATCCCTTTA

1601  AGGCCAGGTT TTCACCGTAA CACGCCACAT CTTGCGAATA TATGTGTAGA
      TCCGGTCCAA AAGTGGCATT GTGCGGTGTA GAACGCTTAT ATACACATCT

1651  AACTGCCGGA AATCGTCGTG GTATTCACTC CAGAGCGATG AAAACGTTTC
      TTGACGGCCT TTAGCAGCAC CATAAGTGAG GTCTCGCTAC TTTTGCAAAG

1701  AGTTTGCTCA TGGAAAACGG TGTAACAAGG GTGAACACTA TCCCATATCA
      TCAAACGAGT ACCTTTTGCC ACATTGTTCC CACTTGTGAT AGGGTATAGT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1751  CCAGCTCACC GTCTTTCATT GCCATACGGA ACTCCGGGTG AGCATTCATC
      GGTCGAGTGG CAGAAAGTAA CGGTATGCCT TGAGGCCCAC TCGTAAGTAG

1801  AGGCGGGCAA GAATGTGAAT AAAGGCCGGA TAAAACTTGT GCTTATTTTT
      TCCGCCCGTT CTTACACTTA TTTCCGGCCT ATTTTGAACA CGAATAAAAA

1851  CTTTACGGTC TTTAAAAAGG CCGTAATATC CAGCTGAACG GTCTGGTTAT
      GAAATGCCAG AAATTTTTCC GGCATTATAG GTCGACTTGC CAGACCAATA

1901  AGGTACATTG AGCAACTGAC TGAAATGCCT CAAAATGTTC TTTACGATGC
      TCCATGTAAC TCGTTGACTG ACTTTACGGA GTTTTACAAG AAATGCTACG

1951  CATTGGGATA TATCAACGGT GGTATATCCA GTGATTTTTT TCTCCATTTT
      GTAACCCTAT ATAGTTGCCA CCATATAGGT CACTAAAAAA AGAGGTAAAA

2001  AGCTTCCTTA GCTCCTGAAA ATCTCGATAA CTCAAAAAAT ACGCCCGGTA
      TCGAAGGAAT CGAGGACTTT TAGAGCTATT GAGTTTTTTA TGCGGGCCAT

                                                AatII
                                                ~~~~~~
2051  GTGATCTTAT TTCATTATGG TGAAAGTTGG AACCTCACCC GACGTCTAAT
      CACTAGAATA AAGTAATACC ACTTTCAACC TTGGAGTGGG CTGCAGATTA

2101  GTGAGTTAGC TCACTCATTA GGCACCCCAG GCTTTACACT TTATGCTTCC
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
      CACTCAATCG AGTGAGTAAT CCGTGGGGTC CGAAATGTGA AATACGAAGG

2151  GGCTCGTATG TTGTGTGGAA TTGTGAGCGG ATAACAATTT CACACAGGAA
      CCGAGCATAC AACACACCTT AACACTCGCC TATTGTTAAA GTGTGTCCTT

                                 XbaI                  SphI
                               ~~~~~~~~              ~~~~~~~
2201  ACAGCTATGA CCATGATTAC GAATTTCTAG ACCCCCCCCC CGCATGCCAT
      TGTCGATACT GGTACTAATG CTTAAAGATC TGGGGGGGGG GCGTACGGTA

                                       HindIII
                                       ~~~~~~~
2251  AACTTCGTAT AATGTACGCT ATACGAAGTT ATAAGCTTGA CCTGTGAAGT
      TTGAAGCATA TTACATGCGA TATGCTTCAA TATTCGAACT GGACACTTCA

                                                     PacI
                                                  ~~~~~~~~~
2301  GAAAAATGGC GCAGATTGTG CGACATTTTT TTTGTCTGCC GTTTAATTAA
      CTTTTTACCG CGTCTAACAC GCTGTAAAAA AAACAGACGG CAAATTAATT

              FseI
          ~~~~~~~~~~
2351  GGGGGGGGGC CGGCCATTAT CAAAAAGGAT CTCAAGAAGA TCCTTTGATC
      CCCCCCCCCG GCCGGTAATA GTTTTTCCTA GAGTTCTTCT AGGAAACTAG
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2401  TTTTCTACGG GGTCTGACGC TCAGTGGAAC GAAAACTCAC GTTAAGGGAT
      AAAAGATGCC CCAGACTGCG AGTCACCTTG CTTTTGAGTG CAATTCCCTA

2451  TTTGGTCATG AGATTATCAA AAAGGATCTT CACCTAGATC CTTTTAAATT
      AAACCAGTAC TCTAATAGTT TTTCCTAGAA GTGGATCTAG GAAAATTTAA

2501  AAAAATGAAG TTTTAAATCA ATCTAAAGTA TATATGAGTA AACTTGGTCT
      TTTTTACTTC AAAATTTAGT TAGATTTCAT ATATACTCAT TTGAACCAGA

2551  GACAGTTACC CAATGCTTAA TCAGTGAGGC ACCTATCTCA GCGATCTGTC
      CTGTCAATGG GTTACGAATT AGTCACTCCG TGGATAGAGT CGCTAGACAG

2601  TATTTCGTTC ATCCATAGTT GCCTGACTCC CCGTCGTGTA GATAACTACG
      ATAAAGCAAG TAGGTATCAA CGGACTGAGG GGCAGCACAT CTATTGATGC

2651  ATACGGGAGG GCTTACCATC TGGCCCCAGT GCTGCAATGA TACCGCGAGA
      TATGCCCTCC CGAATGGTAG ACCGGGGTCA CGACGTTACT ATGGCGCTCT

2701  CCCACGCTCA CCGGCTCCAG ATTTATCAGC AATAAACCAG CCAGCCGGAA
      GGGTGCGAGT GGCCGAGGTC TAAATAGTCG TTATTTGGTC GGTCGGCCTT

2751  GGGCCGAGCG CAGAAGTGGT CCTGCAACTT TATCCGCCTC CATCCAGTCT
      CCCGGCTCGC GTCTTCACCA GGACGTTGAA ATAGGCGGAG GTAGGTCAGA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2801  ATTAACTGTT GCCGGGAAGC TAGAGTAAGT AGTTCGCCAG TTAATAGTTT
      TAATTGACAA CGGCCCTTCG ATCTCATTCA TCAAGCGGTC AATTATCAAA

2851  GCGCAACGTT GTTGCCATTG CTACAGGCAT CGTGGTGTCA CGCTCGTCGT
      CGCGTTGCAA CAACGGTAAC GATGTCCGTA GCACCACAGT GCGAGCAGCA

2901  TTGGTATGGC TTCATTCAGC TCCGGTTCCC AACGATCAAG GCGAGTTACA
      AACCATACCG AAGTAAGTCG AGGCCAAGGG TTGCTAGTTC CGCTCAATGT

2951  TGATCCCCCA TGTTGTGCAA AAAAGCGGTT AGCTCCTTCG GTCCTCCGAT
      ACTAGGGGGT ACAACACGTT TTTTCGCCAA TCGAGGAAGC CAGGAGGCTA

3001  CGTTGTCAGA AGTAAGTTGG CCGCAGTGTT ATCACTCATG GTTATGGCAG
      GCAACAGTCT TCATTCAACC GGCGTCACAA TAGTGAGTAC CAATACCGTC

3051  CACTGCATAA TTCTCTTACT GTCATGCCAT CCGTAAGATG CTTTTCTGTG
      GTGACGTATT AAGAGAATGA CAGTACGGTA GGCATTCTAC GAAAAGACAC

3101  ACTGGTGAGT ACTCAACCAA GTCATTCTGA GAATAGTGTA TGCGGCGACC
      TGACCACTCA TGAGTTGGTT CAGTAAGACT CTTATCACAT ACGCCGCTGG

3151  GAGTTGCTCT TGCCCGGCGT CAATACGGGA TAATACCGCG CCACATAGCA
      CTCAACGAGA ACGGGCCGCA GTTATGCCCT ATTATGGCGC GGTGTATCGT
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
                                         XmnI
                                    ~~~~~~~~~~~~~
3201  GAACTTTAAA  AGTGCTCATC  ATTGGAAAAC  GTTCTTCGGG  GCGAAAACTC
      CTTGAAATTT  TCACGAGTAG  TAACCTTTTG  CAAGAAGCCC  CGCTTTTGAG

3251  TCAAGGATCT  TACCGCTGTT  GAGATCCAGT  TCGATGTAAC  CCACTCGCGC
      AGTTCCTAGA  ATGGCGACAA  CTCTAGGTCA  AGCTACATTG  GGTGAGCGCG

3301  ACCCAACTGA  TCCTCAGCAT  CTTTTACTTT  CACCAGCGTT  TCTGGGTGAG
      TGGGTTGACT  AGGAGTCGTA  GAAAATGAAA  GTGGTCGCAA  AGACCCACTC

3351  CAAAAACAGG  AAGGCAAAAT  GCCGCAAAAA  AGGGAATAAG  GGCGACACGG
      GTTTTTGTCC  TTCCGTTTTA  CGGCGTTTTT  TCCCTTATTC  CCGCTGTGCC

3401  AAATGTTGAA  TACTCATACT  CTTCCTTTTT  CAATATTATT  GAAGCATTTA
      TTTACAACTT  ATGAGTATGA  GAAGGAAAAA  GTTATAATAA  CTTCGTAAAT

                                                  BsrGI

3451  TCAGGGTTAT  TGTCTCATGA  GCGGATACAT  ATTTGAAT
      AGTCCCAATA  ACAGAGTACT  CGCCTATGTA  TAAACTTA
```

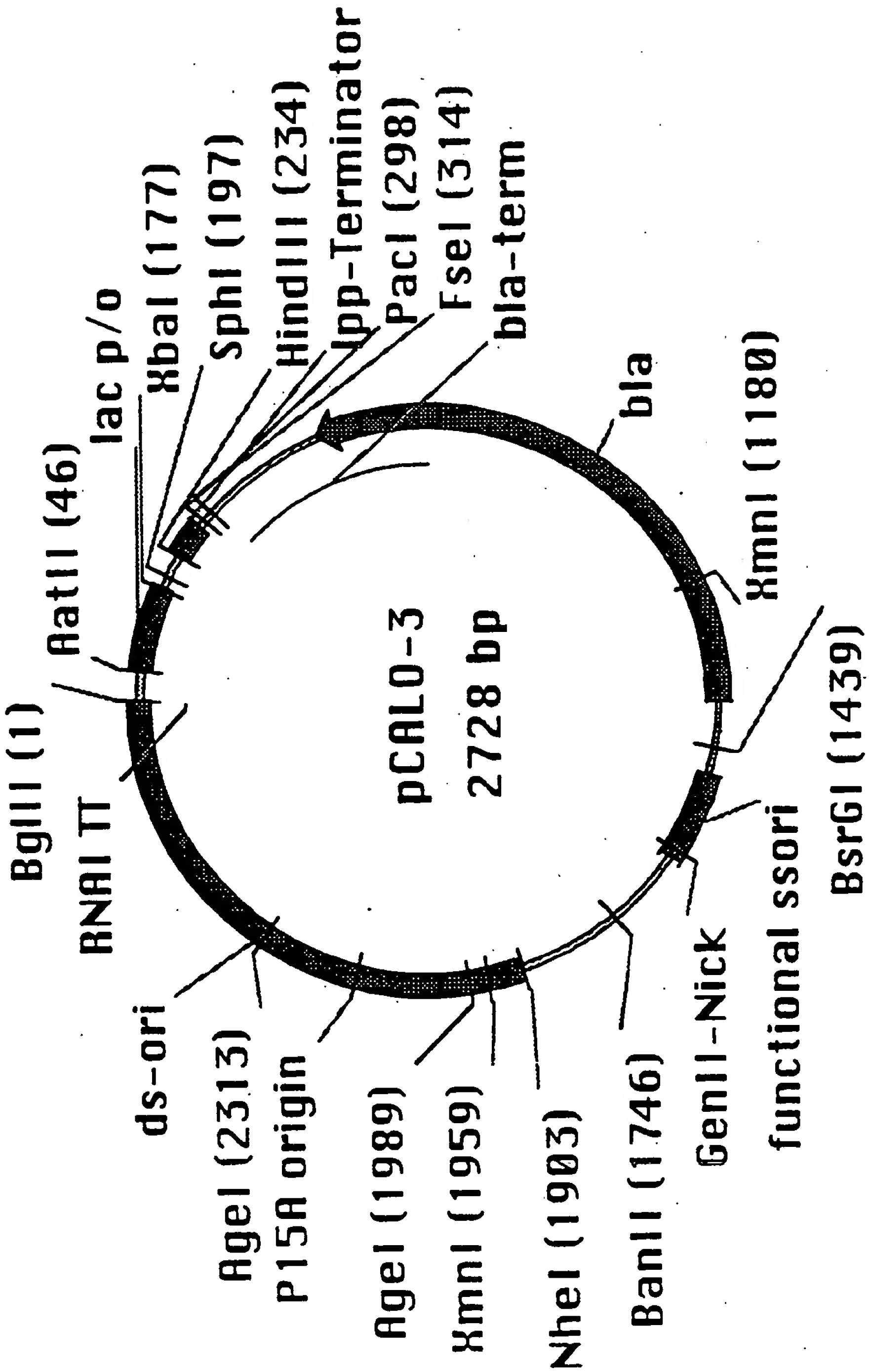


Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
pCALO-3:
      BglII                                                AatII
      ~~~~~~                                              ~~~~~~~
  1   GATCTCATAA CTTCGTATAA TGTATGCTAT ACGAAGTTAT GACGTCTAAT
      CTAGAGTATT GAAGCATATT ACATACGATA TGCTTCAATA CTGCAGATTA

 51   GTGAGTTAGC TCACTCATTA GGCACCCCAG GCTTTACACT TTATGCTTCC
      CACTCAATCG AGTGAGTAAT CCGTGGGGTC CGAAATGTGA AATACGAAGG

101   GGCTCGTATG TTGTGTGGAA TTGTGAGCGG ATAACAATTT CACACAGGAA
      CCGAGCATAC AACACACCTT AACACTCGCC TATTGTTAAA GTGTGTCCTT

                                  XbaI                SphI
                                ~~~~~~~~            ~~~~~~
151   ACAGCTATGA CCATGATTAC GAATTTCTAG ACCCCCCCCC CGCATGCCAT
      TGTCGATACT GGTACTAATG CTTAAAGATC TGGGGGGGGG GCGTACGGTA

                                           HindIII
                                           ~~~~~~~
201   AACTTCGTAT AATGTACGCT ATACGAAGTT ATAAGCTTGA CCTGTGAAGT
      TTGAAGCATA TTACATGCGA TATGCTTCAA TATTCGAACT GGACACTTCA

                                                   PacI
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
                                                           ~~~~~~~~~
251  GAAAAATGGC GCAGATTGTG CGACATTTTT TTTGTCTGCC GTTTAATTAA
     CTTTTTACCG CGTCTAACAC GCTGTAAAAA AAACAGACGG CAAATTAATT

             FseI
          ~~~~~~~~~~
301  GGGGGGGGGC CGGCCATTAT CAAAAAGGAT CTCAAGAAGA TCCTTTGATC
     CCCCCCCCCG GCCGGTAATA GTTTTTCCTA GAGTTCTTCT AGGAAACTAG

351  TTTTCTACGG GGTCTGACGC TCAGTGGAAC GAAAACTCAC GTTAAGGGAT
     AAAAGATGCC CCAGACTGCG AGTCACCTTG CTTTTGAGTG CAATTCCCTA

401  TTTGGTCATG AGATTATCAA AAAGGATCTT CACCTAGATC CTTTTAAATT
     AAACCAGTAC TCTAATAGTT TTTCCTAGAA GTGGATCTAG GAAAATTTAA

451  AAAAATGAAG TTTTAAATCA ATCTAAAGTA TATATGAGTA AACTTGGTCT
     TTTTTACTTC AAAATTTAGT TAGATTTCAT ATATACTCAT TTGAACCAGA

501  GACAGTTACC CAATGCTTAA TCAGTGAGGC ACCTATCTCA GCGATCTGTC
     CTGTCAATGG GTTACGAATT AGTCACTCCG TGGATAGAGT CGCTAGACAG

551  TATTTCGTTC ATCCATAGTT GCCTGACTCC CCGTCGTGTA GATAACTACG
     ATAAAGCAAG TAGGTATCAA CGGACTGAGG GGCAGCACAT CTATTGATGC
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
601  ATACGGGAGG GCTTACCATC TGGCCCCAGT GCTGCAATGA TACCGCGAGA
     TATGCCCTCC CGAATGGTAG ACCGGGGTCA CGACGTTACT ATGGCGCTCT

651  CCCACGCTCA CCGGCTCCAG ATTTATCAGC AATAAACCAG CCAGCCGGAA
     GGGTGCGAGT GGCCGAGGTC TAAATAGTCG TTATTTGGTC GGTCGGCCTT

701  GGGCCGAGCG CAGAAGTGGT CCTGCAACTT TATCCGCCTC CATCCAGTCT
     CCCGGCTCGC GTCTTCACCA GGACGTTGAA ATAGGCGGAG GTAGGTCAGA

751  ATTAACTGTT GCCGGGAAGC TAGAGTAAGT AGTTCGCCAG TTAATAGTTT
     TAATTGACAA CGGCCCTTCG ATCTCATTCA TCAAGCGGTC AATTATCAAA

801  GCGCAACGTT GTTGCCATTG CTACAGGCAT CGTGGTGTCA CGCTCGTCGT
     CGCGTTGCAA CAACGGTAAC GATGTCCGTA GCACCACAGT GCGAGCAGCA

851  TTGGTATGGC TTCATTCAGC TCCGGTTCCC AACGATCAAG GCGAGTTACA
     AACCATACCG AAGTAAGTCG AGGCCAAGGG TTGCTAGTTC CGCTCAATGT

901  TGATCCCCCA TGTTGTGCAA AAAAGCGGTT AGCTCCTTCG GTCCTCCGAT
     ACTAGGGGGT ACAACACGTT TTTTCGCCAA TCGAGGAAGC CAGGAGGCTA

951  CGTTGTCAGA AGTAAGTTGG CCGCAGTGTT ATCACTCATG GTTATGGCAG
     GCAACAGTCT TCATTCAACC GGCGTCACAA TAGTGAGTAC CAATACCGTC
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1001  CACTGCATAA TTCTCTTACT GTCATGCCAT CCGTAAGATG CTTTTCTGTG
      GTGACGTATT AAGAGAATGA CAGTACGGTA GGCATTCTAC GAAAAGACAC

1051  ACTGGTGAGT ACTCAACCAA GTCATTCTGA GAATAGTGTA TGCGGCGACC
      TGACCACTCA TGAGTTGGTT CAGTAAGACT CTTATCACAT ACGCCGCTGG

1101  GAGTTGCTCT TGCCCGGCGT CAATACGGGA TAATACCGCG CCACATAGCA
      CTCAACGAGA ACGGGCCGCA GTTATGCCCT ATTATGGCGC GGTGTATCGT

                                 XmnI
                             ~~~~~~~~~~~~
1151  GAACTTTAAA AGTGCTCATC ATTGGAAAAC GTTCTTCGGG GCGAAAACTC
      CTTGAAATTT TCACGAGTAG TAACCTTTTG CAAGAAGCCC CGCTTTTGAG

1201  TCAAGGATCT TACCGCTGTT GAGATCCAGT TCGATGTAAC CCACTCGCGC
      AGTTCCTAGA ATGGCGACAA CTCTAGGTCA AGCTACATTG GGTGAGCGCG

1251  ACCCAACTGA TCCTCAGCAT CTTTTACTTT CACCAGCGTT TCTGGGTGAG
      TGGGTTGACT AGGAGTCGTA GAAAATGAAA GTGGTCGCAA AGACCCACTC

1301  CAAAAACAGG AAGGCAAAAT GCCGCAAAAA AGGGAATAAG GGCGACACGG
      GTTTTTGTCC TTCCGTTTTA CGGCGTTTTT TCCCTTATTC CCGCTGTGCC

1351  AAATGTTGAA TACTCATACT CTTCCTTTTT CAATATTATT GAAGCATTTA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
      TTTACAACTT ATGAGTATGA GAAGGAAAAA GTTATAATAA CTTCGTAAAT

                                                BsrGI
                                               ~~~~~~~~
1401  TCAGGGTTAT TGTCTCATGA GCGGATACAT ATTTGAATGT ACATGAAATT
      AGTCCCAATA ACAGAGTACT CGCCTATGTA TAAACTTACA TGTACTTTAA

1451  GTAAACGTTA ATATTTTGTT AAAATTCGCG TTAAATTTTT GTTAAATCAG
      CATTTGCAAT TATAAAACAA TTTTAAGCGC AATTTAAAAA CAATTTAGTC

1501  CTCATTTTTT AACCAATAGG CCGAAATCGG CAAAATCCCT TATAAATCAA
      GAGTAAAAAA TTGGTTATCC GGCTTTAGCC GTTTTAGGGA ATATTTAGTT

1551  AAGAATAGAC CGAGATAGGG TTGAGTGTTG TTCCAGTTTG GAACAAGAGT
      TTCTTATCTG GCTCTATCCC AACTCACAAC AAGGTCAAAC CTTGTTCTCA

1601  CCACTATTAA AGAACGTGGA CTCCAACGTC AAAGGGCGAA AAACCGTCTA
      GGTGATAATT TCTTGCACCT GAGGTTGCAG TTTCCCGCTT TTTGGCAGAT

1651  TCAGGGCGAT GGCCCACTAC GAGAACCATC ACCCTAATCA AGTTTTTTGG
      AGTCCCGCTA CCGGGTGATG CTCTTGGTAG TGGGATTAGT TCAAAAAACC

                                                    BanII
                                                   ~~~~~~~
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
1701   GGTCGAGGTG CCGTAAAGCA CTAAATCGGA ACCCTAAAGG GAGCCCCCGA
       CCAGCTCCAC GGCATTTCGT GATTTAGCCT TGGGATTTCC CTCGGGGGCT

1751   TTTAGAGCTT GACGGGGAAA GCCGGCGAAC GTGGCGAGAA AGGAAGGGAA
       AAATCTCGAA CTGCCCCTTT CGGCCGCTTG CACCGCTCTT TCCTTCCCTT

1801   GAAAGCGAAA GGAGCGGGCG CTAGGGCGCT GGCAAGTGTA GCGGTCACGC
       CTTTCGCTTT CCTCGCCCGC GATCCCGCGA CCGTTCACAT CGCCAGTGCG

1851   TGCGCGTAAC CACCACACCC GCCGCGCTTA ATGCGCCGCT ACAGGGCGCG
       ACGCGCATTG GTGGTGTGGG CGGCGCGAAT TACGCGGCGA TGTCCCGCGC

        NheI
       ~~~~~~
1901   TGCTAGCGGA GTGTATACTG GCTTACTATG TTGGCACTGA TGAGGGTGTC
       ACGATCGCCT CACATATGAC CGAATGATAC AACCGTGACT ACTCCCACAG

           XmnI                                AgeI
         ~~~~~~~~~~~                         ~~~~~~~
1951   AGTGAAGTGC TTCATGTGGC AGGAGAAAAA AGGCTGCACC GGTGCGTCAG
       TCACTTCACG AAGTACACCG TCCTCTTTTT TCCGACGTGG CCACGCAGTC

2001   CAGAATATGT GATACAGGAT ATATTCCGCT TCCTCGCTCA CTGACTCGCT
       GTCTTATACA CTATGTCCTA TATAAGGCGA AGGAGCGAGT GACTGAGCGA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2051  ACGCTCGGTC GTTCGACTGC GGCGAGCGGA AATGGCTTAC GAACGGGGCG
      TGCGAGCCAG CAAGCTGACG CCGCTCGCCT TTACCGAATG CTTGCCCCGC

2101  GAGATTTCCT GGAAGATGCC AGGAAGATAC TTAACAGGGA AGTGAGAGGG
      CTCTAAAGGA CCTTCTACGG TCCTTCTATG AATTGTCCCT TCACTCTCCC

2151  CCGCGGCAAA GCCGTTTTTC CATAGGCTCC GCCCCCCTGA CAAGCATCAC
      GGCGCCGTTT CGGCAAAAAG GTATCCGAGG CGGGGGGACT GTTCGTAGTG

2201  GAAATCTGAC GCTCAAATCA GTGGTGGCGA AACCCGACAG GACTATAAAG
      CTTTAGACTG CGAGTTTAGT CACCACCGCT TTGGGCTGTC CTGATATTTC

2251  ATACCAGGCG TTTCCCCCTG GCGGCTCCCT CCTGCGCTCT CCTGTTCCTG
      TATGGTCCGC AAAGGGGGAC CGCCGAGGGA GGACGCGAGA GGACAAGGAC

                  AgeI
                 ~~~~~~
2301  CCTTTCGGTT TACCGGTGTC ATTCCGCTGT TATGGCCGCG TTTGTCTCAT
      GGAAAGCCAA ATGGCCACAG TAAGGCGACA ATACCGGCGC AAACAGAGTA

2351  TCCACGCCTG ACACTCAGTT CCGGGTAGGC AGTTCGCTCC AAGCTGGACT
      AGGTGCGGAC TGTGAGTCAA GGCCCATCCG TCAAGCGAGG TTCGACCTGA
```

Figure 35a: Functional maps and sequences of additional pCAL vector modules and pCAL vectors (continued)

```
2401  GTATGCACGA ACCCCCCGTT CAGTCCGACC GCTGCGCCTT ATCCGGTAAC
      CATACGTGCT TGGGGGGCAA GTCAGGCTGG CGACGCGGAA TAGGCCATTG

2451  TATCGTCTTG AGTCCAACCC GGAAAGACAT GCAAAAGCAC CACTGGCAGC
      ATAGCAGAAC TCAGGTTGGG CCTTTCTGTA CGTTTTCGTG GTGACCGTCG

2501  AGCCACTGGT AATTGATTTA GAGGAGTTAG TCTTGAAGTC ATGCGCCGGT
      TCGGTGACCA TTAACTAAAT CTCCTCAATC AGAACTTCAG TACGCGGCCA

2551  TAAGGCTAAA CTGAAAGGAC AAGTTTTAGT GACTGCGCTC CTCCAAGCCA
      ATTCCGATTT GACTTTCCTG TTCAAAATCA CTGACGCGAG GAGGTTCGGT

2601  GTTACCTCGG TTCAAAGAGT TGGTAGCTCA GAGAACCTAC GAAAAACCGC
      CAATGGAGCC AAGTTTCTCA ACCATCGAGT CTCTTGGATG CTTTTTGGCG

2651  CCTGCAAGGC GGTTTTTTCG TTTTCAGAGC AAGAGATTAC GCGCAGACCA
      GGACGTTCCG CCAAAAAAGC AAAAGTCTCG TTCTCTAATG CGCGTCTGGT

                                BglII

2701  AAACGATCTC AAGAAGATCA TCTTATTA
      TTTGCTAGAG TTCTTCTAGT AGAATAAT
```

Figure 35b: List of oligonucleotides used for synthesis of modules

M1: PCR using template

NoVspAatII: TAGACGTC

M2: synthesis

BloxA-A: TATGAGATCTCATAACTTCGTATAATGTACGCTATACG-AAGTTAT

BloxA-B: TAATAACTTCGTATAGCATACATTATACGAAGTTATG-AGATCTCA

M3: PCR, NoVspAatII as second oligo

XloxS-muta: CATTTTTTGCCCTCGTTATCTACGCATGCGATAACTTCGTA-TAGCGTACATTATACGAAGTTATTCTAGACATGGTCATAGCTGTTTCCTG

M7-I: PCR

gIIINEW-fow: GGGGGGAATTCGGTGGTGGTGGATCTGCGTGCGCTG-AAACGGTTGAAAGTTG

gIIINEW-rev: CCCCCCCAAGCTTATCAAGACTCCTTATTACG

M7-II: PCR

gIIIss-fow: GGGGGGGGAATTCGGAGGCGGTTCCGGTGGTGGC

M7-III: PCR

gIIIsupernew-fow: GGGGGGGGAATTCGAGCAGAAGCTGATCTCT-GAGGAGGATCTGTAGGGTGGTGGCTCTGGTTCCGGTGATTTTG

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

M8: synthesis

lox514-A: CCATAACTTCGTATAATGTACGCTATACGAAGTTATA

lox514-B: AGCTTATAACTTCGTATAGCGTACATTATACGAAGT-TATGGCATG

M9II: synthesis

M9II-fow: AGCTTGACCTGTGAAGTGAAAAATGGCGCAGATT-GTGCGACATTTTTTTTGTCTGCCGTTTAATTAAAGGGGGGGT

M9II-rev: GTACACCCCCCCCAGGCCGGCCCCCCCCCCCTTTAA-TTAAACGGCAGACAAAAAAAATGTCGCACAATCTGCG

M10II: assembly PCR with template

bla-fow: GGGGGGGTGTACATTCAAATATGTATCCGCTCATG

bla-seq4: GGGTTACATCGAACTGGATCTC

bla1-muta: CCAGTTCGATGTAACCCACTCGCGCACCCAACTGATC-CTCAGCATCTTTTACTTTCACC

blaII-muta: ACTCTAGCTTCCCGGCAACAGTTAATAGACTGGATG-GAGGCGG

bla-NEW: CTGTTGCCGGGAAGCTAGAGTAAG

bla-rev: CCCCCCCTTAATTAAGGGGGGGGGCCGGCCATTATCAAA-AAGGATCTCAAGAAGATCC

M11II/III: PCR, site-directed mutagenesis

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

f1-fow: GGGGGGGGCTAGCACGCGCCCTGTAGCGGCGCATTAA

f1-rev: CCCCCCCTGTACATGAAATTGTAAACGTTAATATTTTG

f1-t133.muta: GGGCGATGGCCCACTACGAGAACCATCACCCTAATC

M12: assembly PCR using template

p15-fow: GGGGGGAGATCTAATAAGATGATCTTCTTGAG

p15-NEWI: GAGTTGGTAGCTCAGAGAACCTACGAAAAACCGCCCTG-CAAGGCG

p15-NEWII: GTAGGTTCTCTGAGCTACCAACTC

p15-NEWIII: GTTTCCCCCTGGCGGCTCCCTCCTGCGCTCTCCTGTTCCT-GCC

p15-NEWIV: AGGAGGGAGCCGCCAGGGGGAAAC

p15-rev: GACATCAGCGCTAGCGGAGTGTATAC

M13: synthesis

BloxXB-A: GATCTCATAACTTCGTATAATGTATGCTATACGAAGTTA-TTCA

BloxXB-B: GATCTGAATAACTTCGTATAGCATACATTATACGAAGTTA-TGAGA

M14-Ext2: PCR, site-directed mutagenesis

ColEXT2-fow: GGGGGGAGATCTGACCAAAATCCCTTAACGTGAG

Col-mutaI: GGTATCTGCGCTCTGCTGTAGCCAGTTACCTTCGG

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

Col-rev: CCCCCCCGCTAGCCATGTGAGCAAAAGGCCAGCAA

M17: assembly PCR using template

CAT-1: GGGACGTCGGGTGAGGTTCCAAC

CAT-2: CCATACGGAACTCCGGGTGAGCATTCATC

CAT-3: CCGGAGTTCCGTATGG

CAT-4: ACGTTTAAATCAAAACTGG

CAT-5: CCAGTTTTGATTTAAACGTAGCCAATATGGACAACTTCTTC-GCCCCCGTTTTCACTATGGGCAAATATT

CAT-6: GGAAGATCTAGCACCAGGCGTTTAAG

M41: assembly PCR using template

LAC1: GAGGCCGGCCATCGAATGGCGCAAAAC

LAC2: CGCGTACCGTCCTCATGGGAGAAAATAATAC

LAC3: CCATGAGGACGGTACGCGACTGGGCGTGGAGCATCTGGTCGCA-TTGGGTCACCAGCAAATCCGCTGTTAGCTGGCCCATTAAG

LAC4: GTCAGCGGCGGGATATAACATGAGCTGTCCTCGGTATCGTCG

LAC5: GTTATATCCCGCCGCTGACCACCATCAAAC

LAC6: CATCAGTGAATCGGCCAACGCGCGGGGAGAGGCGGTTTGCGT4TTG-GGAGCCAGGGTGGTTTTTC

LAC7: GGTTAATTAACCTCACTGCCCGCTTTCCAGTCGGGAAACCTGTCGTGCC-AGCTGCATCAGTGAATCGGCCAAC

M41-MCS-fow: CTAGACTAGTGTTTAAACCGGACCGGGGGGGGGCTT-AAGGGGGGGGGGGG

Figure 35b: List of oligonucleotides used for synthesis of modules (continued)

M41-MCS-rev: CTAGCCCCCCCCCCCTTAAGCCCCCCCCCGGTCCGGT-TTAAACACTAGT

M41-fow: CTAGACTAGTGTTTAAACCGGACCGGGGGGGGGCTTAA-GGGGGGGGGGG

M41-rev: CCCCCCCTTAAGTGGGCTGCAAAACAAAACGGCCTCC-TGTCAGGAAGCCGCTTTTATCGGGTAGCCTCACTGCCCGCTTTCC

M41-A2: GTTGTTGTGCCACGCGGTTAGGAATGTAATTCAGCTCCGC

M41-B1: AACCGCGTGGCACAACAAC

M41-B2: CTTCGTTCTACCATCGACACGACCACGCTGGCACCCAGTTG

M41-C1: GTGTCGATGGTAGAACGAAG

M41-CII: CCACAGCAATAGCATCCTGGTCATCCAGCGGATAGTT-AATAATCAGCCCACTGACACGTTGCGCGAG

M41-DI: GACCAGGATGCTATTGCTGTGG

M41-DII: CAGCGCGATTTGCTGGTGGCCCAATGCGACCAGATGC

M41-EI: CACCAGCAAATCGCGCTG

M41-EII: CCCGGACTCGGTAATGGCACGCATTGCGCCCAGCGCC

M41-FI: GCCATTACCGAGTCCGGG

M42: synthesis

Eco-H5-Hind-fow: AATTCCACCATCATCACCATTGACGTCTA

Eco-H5-Hind-rev: AGCTTAGACGTCAATGGTGATGATGGTGG

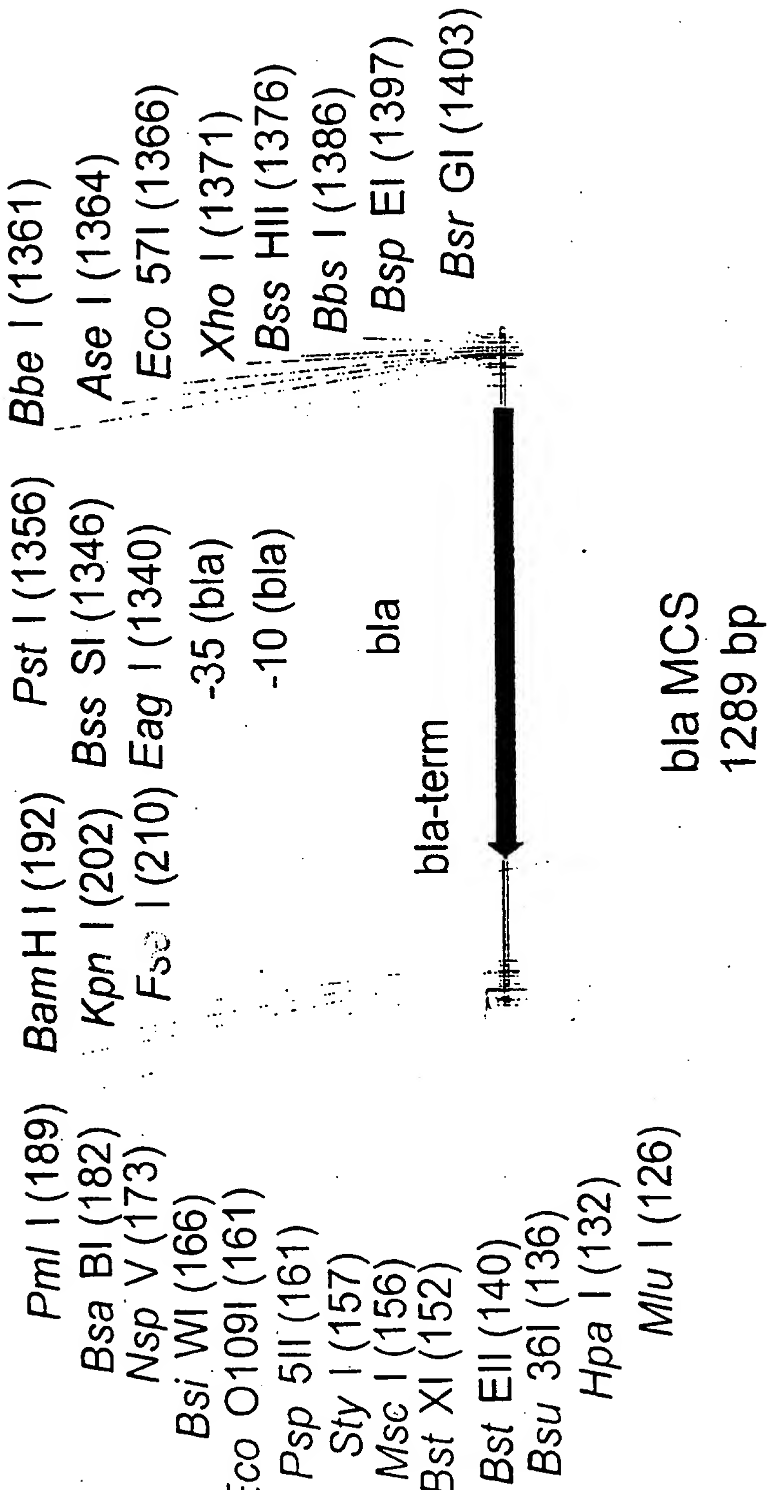


Figure 36: functional map and sequence of ß-lactamase-MCS module

Figure 36: functional map and sequence of ß-lactamase-MCS module (continued)

```
                                         StyI
                                       ~~~~~~~
                                           Psp5II
                                           ~~~~~~~~
     MluI     Bsu36I         BstXI        EcoO109I
     ~~~~~~   ~~~~~~~~~  ~~~~~~~~~~~~~~~  ~~~~~~~~
          HpaI      BstEII          MscI            BsiWI NspV
          ~~~~~~~   ~~~~~~~~        ~~~~~~~~      ~~~~~~~~~~~~~
126  CGCGTTAACC TCAGGTGACC AAGCCCCTGG CCAAGGTCCC GTACGTTCGA
     GCGCAATTGG AGTCCACTGG TTCGGGGACC GGTTCCAGGG CATGCAAGCT

                   PmlI
                 ~~~~~~~
     NspVBsaBI            BamHI   KpnI      FseI
     ~~~~~~~~~~~~~~     ~~~~~~~~~~~~~~~ ~~~~~~~~~~
176  AGATTACCAT CACGTGGATC CGGTACCAGG CCGGCCATTA TCAAAAAGGA
     TCTAATGGTA GTGCACCTAG GCCATGGTCC GGCCGGTAAT AGTTTTTCCT

226  TCTCAAGAAG ATCCTTTGAT CTTTTCTACG GGGTCTGACG CTCAGTGGAA
     AGAGTTCTTC TAGGAAACTA GAAAAGATGC CCCAGACTGC GAGTCACCTT

276  CGAAAACTCA CGTTAAGGGA TTTTGGTCAT GAGATTATCA AAAAGGATCT
     GCTTTTGAGT GCAATTCCCT AAAACCAGTA CTCTAATAGT TTTTCCTAGA
```

Figure 36: functional map and sequence of β-lactamase-MCS module (continued)

```
326  TCACCTAGAT CCTTTTAAAT TAAAAATGAA GTTTTAAATC AATCTAAAGT
     AGTGGATCTA GGAAAATTTA ATTTTTACTT CAAAATTTAG TTAGATTTCA

376  ATATATGAGT AAACTTGGTC TGACAGTTAC CAATGCTTAA TCAGTGAGGC
     TATATACTCA TTTGAACCAG ACTGTCAATG GTTACGAATT AGTCACTCCG

426  ACCTATCTCA GCGATCTGTC TATTTCGTTC ATCCATAGTT GCCTGACTCC
     TGGATAGAGT CGCTAGACAG ATAAAGCAAG TAGGTATCAA CGGACTGAGG

476  CCGTCGTGTA GATAACTACG ATACGGGAGG GCTTACCATC TGGCCCCAGT
     GGCAGCACAT CTATTGATGC TATGCCCTCC CGAATGGTAG ACCGGGGTCA

526  GCTGCAATGA TACCGCGAGA CCCACGCTCA CCGGCTCCAG ATTTATCAGC
     CGACGTTACT ATGGCGCTCT GGGTGCGAGT GGCCGAGGTC TAAATAGTCG

576  AATAAACCAG CCAGCCGGAA GGGCCGAGCG CAGAAGTGGT CCTGCAACTT
     TTATTTGGTC GGTCGGCCTT CCCGGCTCGC GTCTTCACCA GGACGTTGAA

626  TATCCGCCTC CATCCAGTCT ATTAACTGTT GCCGGGAAGC TAGAGTAAGT
     ATAGGCGGAG GTAGGTCAGA TAATTGACAA CGGCCCTTCG ATCTCATTCA

676  AGTTCGCCAG TTAATAGTTT GCGCAACGTT GTTGCCATTG CTACAGGCAT
     TCAAGCGGTC AATTATCAAA CGCGTTGCAA CAACGGTAAC GATGTCCGTA
```

Figure 36: functional map and sequence of ß-lactamase-MCS module (continued)

```
726   CGTGGTGTCA CGCTCGTCGT TTGGTATGGC TTCATTCAGC TCCGGTTCCC
      GCACCACAGT GCGAGCAGCA AACCATACCG AAGTAAGTCG AGGCCAAGGG

776   AACGATCAAG GCGAGTTACA TGATCCCCCA TGTTGTGCAA AAAAGCGGTT
      TTGCTAGTTC CGCTCAATGT ACTAGGGGGT ACAACACGTT TTTTCGCCAA

826   AGCTCCTTCG GTCCTCCGAT CGTTGTCAGA AGTAAGTTGG CCGCAGTGTT
      TCGAGGAAGC CAGGAGGCTA GCAACAGTCT TCATTCAACC GGCGTCACAA

876   ATCACTCATG GTTATGGCAG CACTGCATAA TTCTCTTACT GTCATGCCAT
      TAGTGAGTAC CAATACCGTC GTGACGTATT AAGAGAATGA CAGTACGGTA

926   CCGTAAGATG CTTTTCTGTG ACTGGTGAGT ACTCAACCAA GTCATTCTGA
      GGCATTCTAC GAAAAGACAC TGACCACTCA TGAGTTGGTT CAGTAAGACT

976   GAATAGTGTA TGCGGCGACC GAGTTGCTCT TGCCCGGCGT CAATACGGGA
      CTTATCACAT ACGCCGCTGG CTCAACGAGA ACGGGCCGCA GTTATGCCCT

1026  TAATACCGCG CCACATAGCA GAACTTTAAA AGTGCTCATC ATTGGAAAAC
      ATTATGGCGC GGTGTATCGT CTTGAAATTT TCACGAGTAG TAACCTTTTG

1076  GTTCTTCGGG GCGAAAACTC TCAAGGATCT TACCGCTGTT GAGATCCAGT
      CAAGAAGCCC CGCTTTTGAG AGTTCCTAGA ATGGCGACAA CTCTAGGTCA
```

Figure 36: functional map and sequence of ß-lactamase-MCS module (continued)

```
1126  TCGATGTAAC CCACTCGTGC ACCCAACTGA TCTTCAGCAT CTTTTACTTT
      AGCTACATTG GGTGAGCACG TGGGTTGACT AGAAGTCGTA GAAAATGAAA
                   BssSI                 Eco57I
                  ~~~~~~~                ~~~~~~~

1176  CACCAGCGTT TCTGGGTGAG CAAAAACAGG AAGGCAAAAT GCCGCAAAAA
      GTGGTCGCAA AGACCCACTC GTTTTTGTCC TTCCGTTTTA CGGCGTTTTT

1226  AGGGAATAAG GGCGACACGG AAATGTTGAA TACTCATACT CTTCCTTTTT
      TCCCTTATTC CCGCTGTGCC TTTACAACTT ATGAGTATGA GAAGGAAAAA

1276  CAATATTATT GAAGCATTTA TCAGGGTTAT TGTCTCATGA GCGGATACAT
      GTTATAATAA CTTCGTAAAT AGTCCCAATA ACAGAGTACT CGCCTATGTA

                                 PstI                 XhoI
                               ~~~~~~~~              ~~~~~~
                   EagI    BssSI         BbeI  AseI   BssHII
                 ~~~~~~~~~~~~~~        ~~~~~~~~~~~~~~      ~
1326  ATTTGAATGT ACTCGGCCGC ACGAGCTGCA GGCGCCATTA ATGGCTCGAG
      TAAACTTACA TGAGCCGGCG TGCTCGACGT CCGCGGTAAT TACCGAGCTC

      BssHII                 BspEI BsrGI
      ~~~~~                 ~~~~~~~~~~~~~~
```

Figure 36: functional map and sequence of ß-lactamase-MCS module (continued)

```
1376  CGCGCTTCAG CGCTTTGTCT TCCGGATGTA CATGAAATT
      GCGCGAAGTC GCGAAACAGA AGGCCTACAT GTACTTTAA
          Eco57I        BbsI
          ~~~~~~~      ~~~~~~~~
```

Figure 37: Oligo and primer design for Vκ CDR3 libraries

		1									10								
O_K3L_5	5'-	G	C	C	C	T	G	C	A	A	G	C	G	$\boxed{\text{G A A G A C}}$					
														Bbsl					
														E		D			
Vk1 & Vk3	5'-	G	C	C	C	T	G	C	A	A	G	C	G	$\boxed{\text{G A A G A C}}$					
														E		D			
Vk2	5'-	G	C	C	C	T	G	C	A	A	G	C	G	$\boxed{\text{G A A G A C}}$					
														E		D			
Vk4	5'-	G	C	C	C	T	G	C	A	A	G	C	G	$\boxed{\text{G A A G A C}}$					

Figure 37: Oligo and primer design for Vκ CDR3 libraries

20 30 40

-3'

F A T/V Y Y C Q

T T T G C G A C T T A T T A T T G C C A

G T T

V G V Y Y C

G T G G G C G T G T A T T A T T G C C A

V A V Y Y C

G T G G C G G T G T A T T A T T G C C A

A	
C	
D	
E	
F	T T T
G	
H	C A T
I	
K	
L	C T T
M	A T G
N	
P	
Q	C A G
R	
S	
T	
V	
W	
Y	
	80% Q

Figure 37: Oligo and primer design for Vκ CDR3 libraries

50 60

3'- G G A

T
G A C C T

T
G A C C T

T
G A C C T

G C T			G C T		G C T
G A T	G A T	G A T	G A T		G A T
G A G			G A G		G A G
T T T			T T T		T T T
G G T	G G T	G G T	G G T		G G T
C A T			C A T		C A T
A T T			A T T		A T T
A A G			A A G		A A G
C T T			C T T		C T T
A T G			A T G		A T G
A A T	A A T	A A T	A A T		A A T
			C C T	C C T	C C T
C A G			C A G		C A G
C G T			C G T		C G T
T C T	T C T	T C T	T C T	T C T	T C T
A C T			A C T		A C T
G T T			G T T		G T T
T G G			T G G		T G G
T A T	T A T		T A T		T A T
50% Y				80% P	

Figure 37: Oligo and primer design for Vκ CDR3 libraries

```
          70                          80  81
A A C C G G T A A G C T T T C G   G  -5' O_K3L_3

  [  MscI   ]
F      G      Q
T [T G G C C A] T T C G A A A G C   C  -3'

F      G      Q
T [T G G C C A] T T C G A A A G C   C  -3'
F      G      Q
T [T G G C C A] T T C G A A A G C   C  -3'
```

Figure 38: Oligo and primer design for Vλ CDR3 libraries

```
1                    10                    20
                        E     D     E     A     D
5'- C C T G C A A G C G G A A G A C G A A G C G G A T T -
```

Figure 38: Oligo and primer design for Vλ CDR3 libraries

30 40 50

Y Y C Q S D

-ATTATTGCCAGAGC GAC

A			GCT	GCT -
C				
D			GAT	GAT
E			GAG	GAG
F			TTT	TTT
G			GGT	GGT
H			CAT	CAT
I			ATT	ATT
K			AAG	AAG
L			CTT	CTT
M			ATG	ATG
N			AAT	AAT
P			CCT	CCT
Q			CAG	CAG
R	CGT		CGT	CGT
S			TCT	TCT
T			ACT	ACT
V			GTT	GTT
W	TGG			
Y	TAT		TAT	TAT
	3	1	18	18
	3	1	18	18
	3	1	18	18

Figure 38: Oligo and primer design for Vλ CDR3 libraries

60 70 80

G G G T K L

GGCGGCGGCACGAAGTTA

		gap	gap		
-	GCT	GCT	GCT	GCT	
	GAT	GAT	GAT	GAT	
	GAG	GAG	GAG	GAG	
	TTT	TTT	TTT	TTT	
	GGT	GGT	GGT	GGT	
	CAT	CAT	CAT	CAT	
	ATT	ATT	ATT	ATT	
	AAG	AAG	AAG	AAG	
	CTT	CTT	CTT	CTT	
	ATG	ATG	ATG	ATG	
	AAT	AAT	AAT	AAT	
	CCT	CCT	CCT	CCT	
	CAG	CAG	CAG	CAG	
	CGT	CGT	CGT	CGT	
	TCT	TCT	TCT	TCT	
	ACT	ACT	ACT	ACT	
	GTT	GTT	GTT	GTT	
				TGG	
	TAT	TAT	TAT	TAT	Variability
	18			19	3.32E+05
	18	18		19	5.98E+06
	18	18	18	19	1.08E+08

Figure 38: Oligo and primer design for Vλ CDR3 libraries

```
                90                  100             108
 T     V     L     G     Q     E     F
ACCGTTCTTGGCCAG[GAATTC]GAGCC-3'
             3'-CCGGTCCTTAAGCTCGG-5'
```

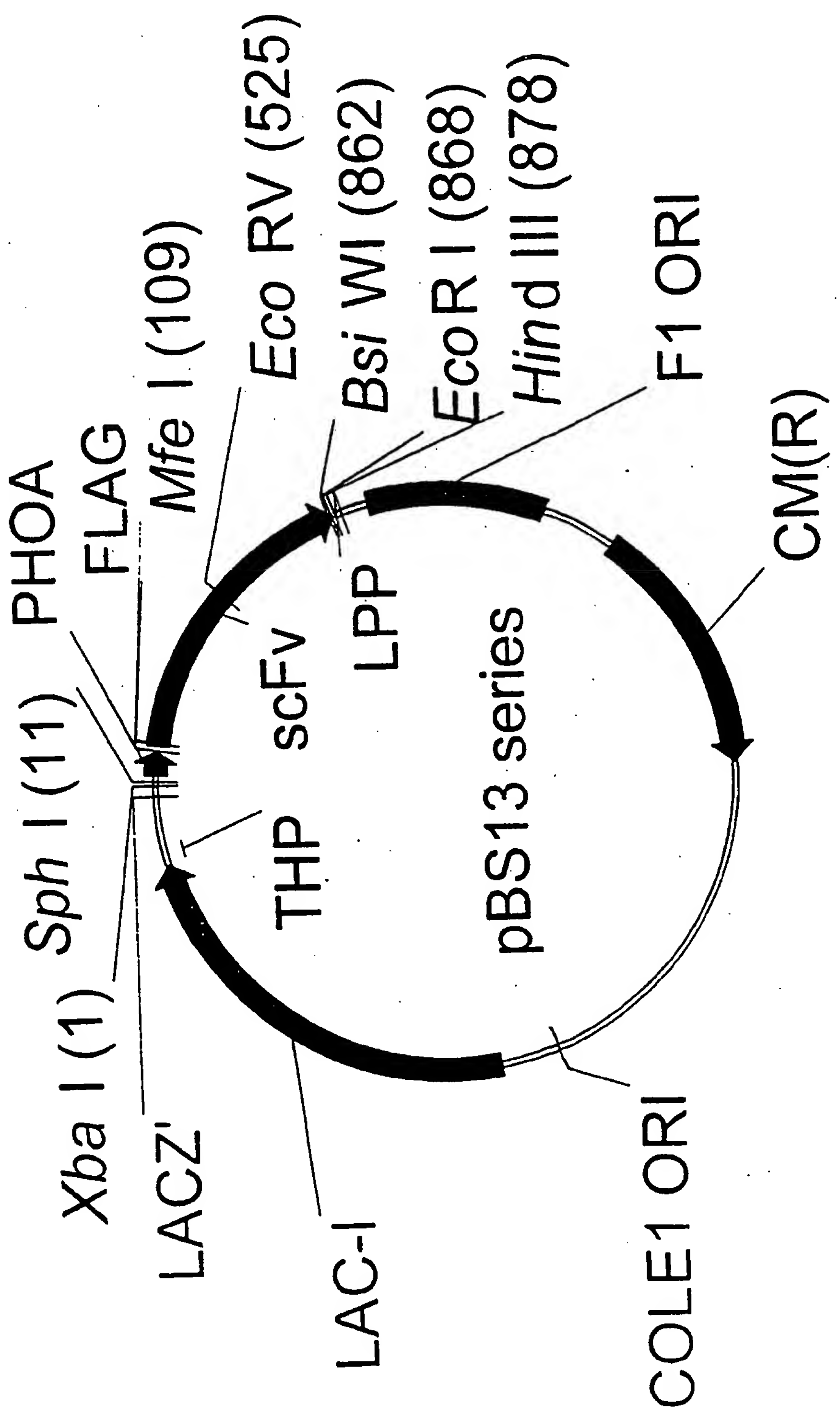


Figure 39: functional map of expression vector series pBS13

Figure 40: Expression data for HuCAL scFvs (pBS13, 30°C)

% soluble	κ1	κ2	κ3	κ4	λ1	λ2	λ3
H1A	61%	58%	52%	42%	90%	61%	60%
H1B	39%	48%	66%	48%	47%	39%	36%
H2	47%	57%	46%	49%	37%	36%	45%
H3	85%	67%	76%	61%	80%	71%	83%
H4	69%	52%	51%	44%	45%	33%	42%
H5	49%	49%	46%	67%	54%	46%	47%
H6	90%	58%	54%	47%	45%	50%	51%

Total amount compared to H3κ2	κ1	κ2	κ3	κ4	λ1	λ2	λ3
H1A	289%	94%	166%	272%	20%	150%	78%
H1B	219%	122%	89%	139%	117%	158%	101%
H2	186%	223%	208%	182%	126%	60%	97%
H3	50%		71%	54%	59%	130%	47%
H4	37%	55%	60%	77%	195%	107%	251%
H5	98%	201%	167%	83%	93%	128%	115%
H6	65%	117%	89%	109%	299%	215%	278%

Figure 40: Expression data for HuCAL scFvs (pBS13, 30°C)

Soluble amount compared to H3κ2	κ1	κ2	κ3	κ4	λ1	λ2	λ3
H1A	191%	88%	121%	122%	26%	211%	76%
H1B	124%	95%	83%	107%	79%	142%	59%
H2	126%	204%	139%	130%	66%	50%	70%
H3	63%	-	81%	49%	69%	143%	61%
H4	40%	47%	49%	54%	95%	55%	125%
H5	69%	158%	116%	80%	72%	84%	84%
H6	85%	122%	87%	77%	162%	162%	212%

	McPC
soluble	38%
%H3k2 total	117%
%H3k2 soluble	69%